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BOARD OF AGRICULTURE IN INDIA

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No. C-1397, dated Camp Pusa, the 5th March 1908.

From—J. MOLLISON, Esqr., M.R.A.C., Inspector General of Agriculture in India,
To—The Secretary to the Government of India, Department of Revenue and
Agriculture, Calcutta.

I have the honour to submit the Proceedings of the 4th Meeting of the Board of Agriculture held at Pusa on the 17th February 1908 and subsequent days. These Proceedings have been recorded by Dr. Butler, who kindly agreed to again act this year as Secretary. The Proceedings have been approved by the Board.

Proceedings of the 4th Annual Meeting of the Board of Agriculture in India, held at Pusa on the 17th February 1908, and succeeding days.

LIST OF MEMBERS.

1. J. MOLLISON, M.R.A.C., *Inspector General of Agriculture in India, President of the Board.*
2. E. J. BUTLER, M.B., F.L.S., *Imperial Mycologist, Pusa, Secretary to the Board.*
3. B. COVENTRY, *Director, Agricultural Research Institute, and Principal of the Agricultural College, Pusa.*
4. J. W. LEATHER, Ph.D., F.I.C., F.C.S., *Imperial Agricultural Chemist, Pusa.*
5. H. M. LEFROY, M.A., F.E.S., F.Z.S., *Imperial Entomologist, Pusa.*
6. C. J. BERGTHIEL, *Imperial Bacteriologist, Pusa.*
7. E. SHEARER, M.A., B.Sc., *Imperial Agriculturist, Pusa.*
8. A. HOWARD, M.A., A.R.C.S., F.C.S., F.L.S., *Imperial Economic Botanist, Pusa.*
9. G. A. GAMMIE, F.L.S., *Imperial Cotton Specialist.*
10. F. M. HOWLETT, B.A., *Second Imperial Entomologist, Pusa.*
11. Captain A. T. GAGE, I.M.S., M.B., M.A., B.Sc., F.L.S., *Director of the Botanical Survey of India.*
12. FRED NOEL-PATON, *Director General of Commercial Intelligence.*
13. I. H. BURKILL, M.A., *Reporter on Economic Products to the Government of India.*
14. C. M. HUTCHINSON, B.A., *Scientific Officer to the Indian Tea Association.*
15. W. R. GOURLAY, I.C.S., *Director of Agriculture, Bengal.*
16. F. SMITH, B.Sc., *Deputy Director of Agriculture, Bengal.*
17. H. H. CORBIN, B.Sc., *Principal of the Agricultural College, Bengal.*
18. E. J. WOODHOUSE, B.A., *Economic Botanist, Bengal.*
19. C. SOMERS-TAYLOR, B.A., *Agricultural Chemist, Bengal.*
20. E. A. MOLONY, I.C.S., *Director of Agriculture. United Provinces of Agra and Oudh.*
21. J. HAYMAN, D.V.S., *Deputy Director of Agriculture, United Provinces of Agra and Oudh.*
22. H. M. LEAKE, M.A., B.Sc., *Economic Botanist, United Provinces of Agra and Oudh.*
23. G. CLARKE, F.I.C., *Agricultural Chemist, United Provinces of Agra and Oudh.*
24. A. PARR, Ph.D., M.A., *Second Deputy Director of Agriculture, United Provinces of Agra and Oudh.*
25. W. C. RENOUF, I.C.S., *Director of Agriculture, Punjab.*

26. S. MILLIGAN, M.A., B.Sc., *Deputy Director of Agriculture, Punjab.*
27. A. C. DOBBS B.A., *Principal, Agricultural College, Punjab*
28. D. MILNE, M.A., B.Sc., *Economic Botanist, Punjab.*
29. J. H. BARNES, B.Sc., A.I.C., F.C.S., *Agricultural Chemist Punjab.*
30. H. H. MANN D.Sc., *Principal, Agricultural College, Poona.*
31. J. B. KNIGHT, M.Sc., *Professor of Agriculture, Agricultural College Poona.*
32. G. S. HENDERSON, N.D.A. N.D.D., *Second Deputy Director of Agriculture Bombay.*
33. M. E. COUCHMAN, I.C.S., *Director of Agriculture, Madras.*
34. H. C. SAMPSON B.Sc., F.H.A.S., F.B.S.E., *Deputy Director of Agriculture, Madras.*
35. C. J. W. SHEPHERSON, B.Sc., *Principal, Agricultural College, Madras*
36. W. H. HARRISON, M.Sc., *Agricultural Chemist, Madras.*
37. RAO BAHADUR C. K. SUBBA RAO, B.A., *Acting Economic Botanist, Madras.*
38. F. G. SLY, I.C.S., *Director of Agriculture, Central Provinces.*
39. D. CLOUSTON, M.A., B.Sc., *Deputy Director of Agriculture, Central Provinces (South Circle).*
40. F. C. PLYMAN, A.C.G.I., *Agricultural Chemist, Central Provinces.*
41. G. EVANS, B.A., *Deputy Director of Agriculture, Central Provinces (North Circle).*
42. R. J. D. GRAHAM, M.A., B.Sc., *Economic Botanist, Central Provinces.*
43. S. G. HART, I.C.S., *Director of Agriculture, Eastern Bengal and Assam.*
44. RAI BAHADUR D. C. BASU, M.R.A.C., *Assistant Director of Agriculture, Eastern Bengal and Assam.*
45. A. A. MEGGITT, B.Sc., *Agricultural Chemist, Eastern Bengal and Assam*
46. R. S. FINLOW, B.Sc., F. C. S., *Fibre Expert to the Government of Eastern Bengal and Assam.*
47. J. MACKENNA I.C.S., *Director of Agriculture, Burma.*
48. A. MCKERRAL, M.A., B.Sc., *Deputy Director of Agriculture, Burma.*
49. L. C. COLEMAN Ph.D., *Mycologist and Entomologist to the Government of Mysore.*
50. M. A. SITOLE, *Director of Agriculture and Industries, Baroda.*
51. L. C. SHARMA, M.R.A.C., P.A.S.I., *Bar-at-Law, Director of Agriculture, Kashmir.*

VISITORS.

52. H. E. ABBOTT, *Editor, Indian Fowl Fanciers' Gardeners' and Farmers' Gazette.*
53. A. G. BIRT, B.Sc., *Supernumerary Agriculturist, Pusa.*
54. W. ROBERTS, B.Sc., *Supernumerary Agriculturist, Pusa.*
55. C. W. MASON, *Supernumerary Entomologist, Pusa.*
56. H. E. ANNETT, B.Sc., *Supernumerary Agricultural Chemist, Pusa.*
57. G. P. HECTOR, M.A., B.Sc., *Supernumerary Economic Botanist, Pusa.*
58. M. E. VANDERKERKHOVE *Flax Expert to the Bihar Planters' Association.*

FIRST DAY.

1. The President welcomed the members present at the 4th Meeting of the Board of Agriculture. He referred in an appreciative manner to the work done by Mr. Sly in organising the proceedings of previous meetings and to Dr. Butler's work in recording the proceedings. He suggested that some of the items put down for discussion on this occasion should be threshed out by Committees appointed to consider them before being discussed by the full Board. This

suggestion being adopted, the following Committees and terms of reference were decided upon:—

(A).—To consider and report on the future constitution of the Board of Agriculture.

Sub-Committee.—The President (Chairman), Mr. Noel-Paton, the Directors of Agriculture, Bengal, United Provinces, Punjab, Madras, Central Provinces, Burma and Eastern Bengal and Assam, Mr. Coventry, Dr. Butler, Mr. Gammie and Dr. Mann.

Terms of reference.—To consider carefully the suggestions† of the Government of India that the Board of Agriculture be reduced to 32 members as follows:—

† Revenue and Agriculture Department Circular No. 23-24-24, dated the 15th August 1907, to all Local Governments

Imperial Officers.	Provincial Officers
Inspector General of Agriculture, President Inspector General, Civil Veterinary Department. Director, Botanical Survey of India Director General of Commercial Intelligence, representing the Commerce and Industry Department	The Director of Agriculture and one Provincial Expert from each of the following Provinces to be selected by the Director:— Bombay Bengal. Eastern Bengal and Assam. Madras Burma
Director Agricultural Research Institute, Pusa, Imperial Agricultural Chemist	Central Provinces, United Provinces, Punjab.
Imperial Mycologist	* A representative of the Provincial Biologists
Imperial Entomologist Imperial Agriculturist Imperial Economic Botanist	* A representative of the Provincial Chemists.
Imperial Bacteriologist.	One member each of the Agricultural Departments of Mysore, Baroda and Kashmir.

In addition to the members of the Board, the Government of India further trust that Local Governments will allow a certain number of their experts to be present as visitors, although they would not take part in the deliberations of the Board unless specially invited by the President to do so.

To consider whether the Chemical, Biological and Educational Sections of each Province should be more fully represented on the Board than above suggested.

To consider whether, in the event of expanding these suggestions, Provincial representation will not be fully secured by appointing the 8 Directors of Agriculture and 12 provincial experts, and whether the latter should be selected in consultation by the Directors themselves.

To make any other proposals on the subject.

(B).—To consider and report on the form of report of the Proceedings of the Board of Agriculture.

Sub-Committee.—Mr. MacKenna (Chairman), Mr. Renouf and Dr. Butler.

Terms of reference.—To consider the suggestions† of the Government of India that the arrangement now adopted for printing the Proceedings of the Board is not a convenient one and that the addition of an index would enhance their value for purposes of reference.

† Revenue and Agriculture Department letter No. 208-28-49, dated the 1st February 1908, to the Inspector General of Agriculture.

* These two members to be selected as follows:—Three days before the general meeting of the Board, the Biological Experts, Imperial and Provincial, that is, the Botanists, Entomologists, Mycologists and Bacteriologists should hold a meeting for the discussion of matters specially affecting their branches of research and should arrive at their own conclusions on such matters, to be placed before the general meeting of the Board. The Provincial Biological experts should select one of their number to be their representative on the Board. Similarly the Imperial and Provincial Chemists would hold a separate meeting three days before the general meeting of the Board, would draw up their conclusions on chemical matters, and appoint a Provincial Chemist to be a member of the Board.

To consider whether such voluminous appendices as were published in the report of the Proceedings of the 3rd Meeting of 1907, should not be excluded from the report and otherwise dealt with.

To give an opinion regarding the best means of publishing notes like those submitted by Mr. Clouston on "Sann hemp, Agave and Ambari as Fibre crops in the Central Provinces and Berar" and "the Introduction of Improvements into Indian Agriculture," and whether these notes are not more suitable for the Agricultural Journal than for the report of the Proceedings of the Board of Agriculture.

(C).—To consider and report on the programme of work of the Imperial Agriculturist and how the other experts of the Imperial Department should collaborate in this work.

Sub-Committee.—The President (Chairman), Messrs. Sly, Coventry, Couchman, Dr. Leather, Mr. Lefroy, Dr. Mann, Messrs. Shearer, Bergtheil, Sampson and Milne.

Terms of reference.—To consider and report how far the permanent experiments proposed for Pusa are likely to give work-a-day results which will have general practical application in Indian Agriculture and also the important directions in which the work of the Pusa Experts should be collaborated in relation to these experiments.

(D).—To consider and report on the best methods of bringing experimental work of proved value to the notice of cultivators.

Sub-Committee.—Mr. Sly (Chairman), Mr. Gourlay, Dr. Mann, Messrs. Hayman, Clouston, Knight and Subba Rao.

Terms of reference.—In addition to recommending methods, specific instances of agricultural improvements which have been introduced by Agricultural Departments should be given with details.

(E).—To consider and report on the cultivation in India of fibre plants and the probable effect of extending such cultivation on the material prosperity of the country.

Sub-Committee.—Messrs. Gammie (Chairman), Burkill, Finlow, Clouston and Subba Rao.

Terms of reference.—To consider and report in concise form all that is generally known on this subject in each province in which important fibre crops are now grown.

(F).—To consider and report on the scope of Poultry breeding in India.

Sub-Committee.—The President (Chairman), Messrs. Abbott, Shearer and Evans.

Terms of reference.—To consider the following request* of the Government of India in forwarding a letter (Appendix E) from Mr. H. Abbott on this question:—
"The Government of India are inclined to think that something might be done by the Agricultural Department to improve the breed of poultry in India, but before making any definite suggestions to Local Governments on the subject, they would be glad of the advice of the Board of Agriculture and I am to request that the subject may be considered at the next meeting of the Board."

(G).—To consider and report on the Syllabus of studies in the Pusa and in Provincial Colleges.

Sub-Committee.—Mr. Renouf (Chairman), Dr. Mann, Dr. Leather, Mr. Dobbs, Dr. Butler, Messrs. Evans, Gammie, Clarke, Barnes, Knight, Sampson, Meggitt, Howlett, Shepperson, Plyman and Leake.

Terms of reference. (a) To make recommendations as to what class of instruction, given at Pusa, will be of the most advantage to the Provinces, and submit a suitable syllabus.

(b) Whether an advantage will lie in the appointment of a permanent committee of officers from the Provinces to co-operate with the Pusa staff in regulating the courses of instruction at Pusa so as to secure the requirements of the Provinces.

(c) To report if any alteration is needed in the standard curriculum for Provincial Colleges as drafted in the Board's Proceedings for 1906 and, if so, to submit a revised curriculum.

* Revenue and Agriculture Department letter No. 189-79-2, dated the 30th January 1908, to the Inspector General of Agriculture in India.

(H). -To consider and report on the Agricultural Chemistry Section of the Programme of the Imperial Department of Agriculture for 1908-09.

Sub-Committee.—Mr. Sly (Chairman), Mr. Coventry, Dr. Leather, Mr. Berghtheil, Dr. Mann, Messrs. Barnes, Hutchinson, Harrison, Clarke and Molony.

Terms of reference.—To suggest whether any modification in the Programme of the Agricultural Chemistry Section of Pusa is necessary.

SECOND, THIRD AND FOURTH DAYS.

These days were occupied in the deliberations of the Sub-Committees appointed on the first day.

FIFTH DAY.

CONFIRMATION OF THE PROCEEDINGS OF THE LAST MEETING.

2. The minutes of the Proceedings of the last annual meeting of the Board of Agriculture held at Cawnpore on the 18th of February 1907, and following days were confirmed.

A note was presented by the President showing the action taken on the recommendations of the last Board.

THE FUTURE CONSTITUTION OF THE BOARD OF AGRICULTURE.

3. The report of Sub-Committee (A) on the future constitution of the Board of Agriculture was considered.

Mr. Smith advocated the holding of an informal conference of all members of the Agricultural Departments in India and the limiting of the official Board to 10 members, composed as follows:—The Inspector-General of Agriculture (President), one representative of each Province, and the Director of the Imperial Institute. If necessary, one representative each of the Chambers of Commerce, the Zemindari interest, and the Planting industry might be added. Mr. Milligan held that it will be impossible to criticise the Provincial programmes if the men specifically responsible for the work be not present at the meeting. Mr. Hayman suggested that the expert mentioned in item 13 should be selected at a meeting of the whole of the staff in each Province with the Director as Chairman. Messrs. Hayman, Milligan and Knight considered that the Provincial Deputy Directors of Agriculture are not sufficiently represented in the proposed constitution. Mr. MacKenna pointed out that, ordinarily, the expert selected by each Director of Agriculture under item 13 would belong to this class. The President also explained that the six nominations suggested in item 15 are intended to secure additional representation in regard to specific subjects set down for discussion in any particular year; and that Deputy Directors are likely to be included in these.

The Board adopts the report of Sub-Committee (A) as follows:—

4. The Sub-Committee recommends that the Board of Agriculture be constituted as follows:—

Imperial Members—

1. The Inspector General of Agriculture (President)	..	..	1
2. The Director, Agricultural Research Institute, Pusa	..	..	1
3. The Imperial Agricultural Chemist	..	..	1
4. The Imperial Mycologist	..	..	1
5. The Imperial Entomologist	..	..	1
6. The Imperial Bacteriologist	..	..	1
7. The Imperial Agriculturist	..	..	1
8. The Imperial Economic Botanist	..	..	1
9. The Imperial Cotton Specialist	..	..	1
10. The Director General of Commercial Intelligence, representing the Department of Commerce and Industry	..	..	1
11. The Reporter on Economic Products or an Economic Botanist from the Botanical Survey of India	..	..	1

Total Imperial Members .. 11

Provincial and Non-Official Members—

12	The Directors of Provincial Departments of Agriculture	8
13	One member from the Expert Staff of each Provincial Department of Agriculture to be nominated by the Provincial Director from any section of his staff	8
14	Provincial Deputy Director of Agriculture	1
	Provincial Agricultural Chemist	1
	Provincial Botanist	1
	Provincial Principal of an Agricultural College	1
		4
15	Members to be nominated each year by the President	6
16	One representative of the Agricultural Departments of Native States to be nominated each year by the President	1
	Total Provincial and Non-official Members	27
	Grand Total	38

*The four officers under No. 14 to be elected by all the Provincial representatives of each section by correspondence before the nomination of the members in the item No. 13.

The Sub-Committee further recommends that when the meeting is held at Pusa (i.e., in each alternate year) all members of the Agricultural Departments in India, including Native States which have an organised Agricultural Department, be invited to attend, not as members of the Board but as visitors.

THE FORM OF REPORT OF THE PROCEEDINGS OF THE BOARD OF AGRICULTURE.

5. The Board adopts the report of Sub-Committee (B) on the form of report of the Proceedings of the Board of Agriculture as follows:—

(1) The Sub-Committee is of opinion that the "Proceedings of the Meeting" should be recorded in the form hitherto adopted.

(2) With regard to appendices the Sub-Committee considers that the programme of the Meeting, the programme of the Imperial Department of Agriculture and the programmes of the Provincial Departments of Agriculture should be included, but that the latter should be as concise as possible.

(3) The Sub-Committee is of opinion that the inclusion of a note showing the action taken on the Proceedings of the preceding Board is unnecessary. In many cases it is improbable that the action taken on such recommendations can be completed within a year and such a note is apt to give a totally inadequate idea of what Agricultural Departments are doing in the matter.

(4) With regard to papers on special crops, e.g., wheat, sugarcane, etc., which form the subject of discussion by the Board, the Sub-Committee is of opinion that these papers, being absolutely relevant to the discussion and an instructive summary of past work in each Province, should be included amongst the appendices. It is recommended, however, that such notes should be as brief as possible.

(5) With regard to papers on general subjects, e.g., papers on commercial Fertilizers, the Improvement of Indian Agriculture, etc., the Sub-Committee is of opinion that such articles should not be incorporated in the appendices but should be published in the Agricultural Journal.

(6) The Sub-Committee considers that a detailed index is unnecessary. A carefully prepared table of contents appears to be all that is required.

PROGRAMMES OF PROVINCIAL DEPARTMENTS OF AGRICULTURE.

6. Mr. Sly proposed for consideration two matters of principle applying, in greater or less degree, to all the programmes submitted to the Board. In the first place, it appears necessary to secure a fuller recognition of the essential function of the Board in helping Provincial Departments with advice and criticism regarding the lines of work proposed in each Province. To secure the proper exercise of this function the Board requires to have available in the printed

programmes a certain amount of detail in matters such as the objects aimed at in opening new experiment stations and the lines of work of new experiments. In the second place, the impetus given to the development of Agricultural work in the last few years appears to have led to the danger in some Provinces of a more rapid development of agricultural stations than the existing staff can cope with. The President and Mr MacKenna expressed general agreement with these views.

7. The Board is of opinion that the Programmes submitted to it should show concisely (1) in the case of new experiment stations the general scheme of work to be undertaken, and (2) in the case of new lines of experimental work, an account of the methods which it is proposed to adopt.

8. It is further of opinion that the form of the Madras and Central Provinces Programmes is, with some additions, explaining more fully the schemes of experiments, the best suited to meet the requirements of the Board.

9. The Board deprecates increasing the number of Provincial experiment stations until the following essential requirements can be secured in each case:—

- (1) Efficient supervision by the superior staff.
- (2) Efficient management by a trained subordinate staff.
- (3) Sufficient equipment for all the experimental work that is to be undertaken.

10. Mr. Renouf raised the question of the area with which it is advisable to commence in opening new farms or in extending existing farms particularly for seed distribution and demonstration work. In the Board's Proceedings for 1906, item 23, it is recommended that experimental farms should be opened in each definite agricultural tract. Seed production should be provided for, either on separate farms or on separate portions of existing farms. An area of from 300 to 500 acres has been recommended for combined experimental and seed farms. This he considered unnecessarily large in some cases and he desired the opinion of the Board, in view of the high value of the land in certain areas, whether a commencement cannot be made on a considerably smaller scale, say not exceeding 100 acres. When expansion for seed production is required it will be possible to take up land on hire for the purpose. This should also be done in the case of areas required for demonstration.

The President stated that in Bombay the commencement was made on a modest scale. The farms at first started were about 50 acres in area. Gradually, as occasion arose, an extension outside the farm was made. Small plots were taken up, such as a 5-acre patch in an outside cultivator's field, for purposes of demonstration. This was worked on methods within the reach of the ordinary cultivator and under his eye, and he was shown that practical improvements can be obtained by improved methods of cultivation. Seed growing and seed distribution can be arranged for in a similar manner.

Mr. Smith considered an area of 50 acres too small. In Bengal 200 acres have been taken up as a standard, part being reserved for experimental work and part for seed growing.

Mr. Coventry held that the area required depends entirely on the uniformity of the soil. Where the land is known it is usually possible to select 50 or 100 acres sufficiently uniform to provide for all the experimental work likely to be required. Where, however, the character of the land is not known, probably some 200 or 300 acres must be taken up from which the area required for experimental work can be selected. For seed-growing use can probably be made in most cases of the land of the cultivator.

Mr. MacKenna considered that the matter is one which depends largely on local conditions. In Burma it pays to take up considerable areas for farms because prices are low at present but are rapidly rising. Areas not immediately required can be temporarily sublet.

11. The Board is of opinion that the area of an experiment station should be limited to the land required for the conduct of the experimental programme and that each Provincial Department should be free to make such arrangements for seed growing and demonstration as it thinks best.

12. It further considers that when an experimental farm is founded, it should be established to solve a definite problem or series of problems. It deprecates

the founding of experimental farms merely in order to represent agricultural tracts unless the special requirements of the particular tract have been previously ascertained, and experiments are considered necessary in order to decide how best to meet them.

13. Mr. Knight suggested that in the case of a programme divided into sections, the name of the expert officer who is actually in charge of the work should be indicated. This is done in the Central Provinces programme which illustrates clearly what he means. Mr. Henderson supported this suggestion. Mr. Couchman did not believe that this procedure is advisable or even possible in some cases. It would mean splitting the programme up into sections and would emphasise a division which should not exist. This view was supported by Mr. Molony. Mr. Milne agreed with Mr. Couchman and said that the proposal would be most difficult of application in practice especially where collaboration between officers exists. The Board considers that this matter is sufficiently covered by the resolution (item 8) approving of the form of the Madras and Central Provinces programme.

14 The Board is of opinion that at least in the alternate years when it meets at Pusa, the Imperial and Provincial programmes should be referred to sectional committees of (1) Deputy Directors, (2) Chemists and (3) Biologists, to consider the items pertaining to their sections with a view to co-ordinating the work of the whole Department, and report their recommendations to the Board.

PROGRAMME OF THE BENGAL DEPARTMENT OF AGRICULTURE

See Appendix C., page 17.

15. The President stated that he was struck by the extent and varied nature of the Bengal programme. He would be glad to know whether the Bengal Director considers that his staff is sufficient to carry out the proposed work.

Mr. Gourlay detailed the available subordinate staff in Bengal. Besides the men previously available, three students with an advanced training have recently joined the Department. These men first graduated from the Calcutta University, then took the Agricultural course at Sibpur College, then went through a practical training in Bengal and finally were sent to one of the best Agricultural Colleges in the United States for a further course. Four more similarly trained men will be available shortly. These men will be put in charge of Agricultural Stations. Mr. Sly considered it unwise to place men of this class in independent charge of Agricultural Stations unless they are first put for a considerable time on one of the existing stations to become practically acquainted with the lines of work likely to be of advantage to the Province.

Dr. Mann feared that there is a tendency apparent from the Bengal programme to start farms without a definite object in view. He considered that in every case a definite object should be borne in mind. Mr. Milhgan agreed that farms should not be started without a definite object in view. Mr. Smith said that in every case such an object was in view when founding the farm.

16. The Board accepts the Bengal programme.

PROGRAMME OF THE UNITED PROVINCES DEPARTMENT OF AGRICULTURE

See Appendix C., page 13.

Mr. Hayman, in response to an enquiry by Mr. Sly, promised to give the details of the investigation regarding the renewal of the seed stock of potatoes in the hills mentioned in the first paragraph of the programme, to any members of the Board interested in the matter.

17. The Board accepts the United Provinces programme.

PROGRAMME OF THE PUNJAB DEPARTMENT OF AGRICULTURE

See Appendix C., page 13.

18. The Board accepts the Punjab programme.

PROGRAMME OF THE BOMBAY DEPARTMENT OF AGRICULTURE.

See Appendix C., page 46.

19. Mr. Knight, in response to inquiries, explained that the experiments in dry farming mentioned in the programme of the Poona College Station are intended to ascertain the best means of conserving soil moisture in dry years by tillage and other similar methods.

20. Dr. Mann explained that no programme in Agricultural Chemistry was included in the programme as he had had no opportunity of submitting one.

21. Mr. Knight stated that the farm at Muvalia is situated in the most backward agricultural tract of the Presidency and is intended to introduce better general methods of cultivation in the neighbourhood. It is in some respects rather a demonstrational than an experimental farm.

22. Mr. MacKenna considered that no advantage is gained by inserting details of area, meteorology and the like into the list of farms given in the programme. Such details can be obtained from the special farm reports. Mr. Sly objected to the form of the programme, which he considered to be framed in such general terms as to render it impossible for the Board to express an opinion on its merits. Such items as that insect pests are being investigated or that an endeavour is being made to introduce into Sind a common Egyptian rotation may mean very much or very little according to the details of the work. Dr. Mann said that the Bombay officers would be glad to give details. Mr. Henderson said that the details of the alkali investigations could be furnished on the following day to any member interested in the question.

23. The Board decides that in the light of the remarks made above, the Bombay programme requires revision.

PROGRAMME OF THE MADRAS DEPARTMENT OF AGRICULTURE.

See Appendix C., page 50.

24. The Board suggests that the reference to systematic work performed by the Government Botanist in his capacity as an officer of the Botanical Survey be omitted in future from the programme of the Madras Agricultural Botanist.

The Board accepts the Madras programme.

PROGRAMME OF THE CENTRAL PROVINCES DEPARTMENT OF AGRICULTURE.

See Appendix C., page 51.

25. The Board accepts the Central Provinces programme.

PROGRAMME OF THE BURMA DEPARTMENT OF AGRICULTURE

See Appendix C., page 53.

26. Mr. MacKenna stated that the full programme of the Hmawbi Farm cannot be carried out this year, owing to a recent curtailment of the Government grant for the purpose. Government sanction has now been received for the entertainment of the Assistant Botanist mentioned in the first paragraph of the programme. The enquiry in connection with silt will be carried out in consultation with the Irrigation Department.

27. The Board is of opinion, that, as the question of alkali lands is of minor importance in Burma, and is being treated in detail in other Provinces where it is of greater urgency, the Agricultural Chemist might be more usefully employed in other and more important investigations.

PROGRAMME OF THE EASTERN BENGAL AND ASSAM DEPARTMENT OF AGRICULTURE.

See Appendix C., page 56.

28. The Board is of opinion that the expert staff of this Department is insufficient to carry out the work set down in the programme.

29. Mr. Sly considered that the appointment mentioned in paragraph 2 of a student trained in Bengal and the United States, directly to the post of Agricultural

Supervisor, is unwise in the extreme. Considerable experience of local work and conditions is required before a student can be given a post of such responsibility. Mr. Hart explained that owing to the fact that the present staff contains only one expert Agriculturist (the Assistant Director), whose time is fully occupied by other duties, there is no officer who can undertake the training of the Agricultural Supervisor. The latter can, however, do much useful work in the shape of local enquiries and will be expected gradually to familiarise himself with the work on all the farms. Until he has acquired experience he will not be placed in charge of any farm and even then only under the immediate supervision of the Assistant Director.

30. In response to enquiries, Mr. Hart explained that the experiment outlined in paragraph 5, section 3, together with the whole of the Dacca Farm programme, had been discussed during the present meeting with certain members of the Board. The experiment is really an attempt to bring a barren field on the farm into a state of fertility for future use. It is in no sense an experiment intended to be applied in ordinary cultivation.

31. Mr. Sly considered that the experiments suggested in paragraph 13 to be tried on Government and Wards Estates can serve no useful purpose as they are not likely to be properly carried out. Such Estates may be useful for demonstration purposes. Mr. Hart agreed but wished to point out that demonstrations carried out in a new locality partake of the nature of experiments. They are experiments which the Department expects to succeed.

32. Mr. Couchman referred to paragraph 17 and considered that the supervision of road-side arboricultural operations is an enormous undertaking for an Agricultural Department. Mr. Hart explained that the work will be carried out by district Officers, the Department only advising. Mr. Molony described the method adopted in the United Provinces, where the whole administrative and executive work is in the hands of District Officers in localities where no Forest Officers are available. The details are submitted to the Agricultural Department which gives advice as far as it can.

33. The Board is of opinion (some members dissenting) that arboricultural operations of the sort referred to in paragraph 17 of the Eastern Bengal programme are outside the scope of the Agricultural Department.

PROGRAMME OF THE MYSORE DEPARTMENT OF AGRICULTURE.

34. Dr. Coleman stated that owing to considerable administrative changes, the programme of the Mysore Department as submitted is unlikely to be carried out, except in certain items where the work is already well advanced. It is impossible to decide on definite work until the intentions of the Mysore Government are more fully known.

35. The Board decides to omit this programme from its proceedings for the reasons stated above. It further regrets to learn that the prospective change in establishment of the Department will, in a great measure, bring agricultural work in Mysore to a standstill.

PROGRAMME OF THE BARODA DEPARTMENT OF AGRICULTURE

See Appendix C., page 63.

36. The Board is of opinion that the experiments in paragraph 2 of this programme are unlikely to lead to any useful results.

37. Mr. Bergtheil expressed the opinion that the experiment mentioned in paragraph 14 is useless if by "nitrogen bacilli" are meant the ordinary nodule bacilli of legumes. It is well established that the presence of a rich organic manure tends to neutralise any benefit which may result from the application of these bacilli.

38. The Board considers that the programme of the Baroda State is much too ambitious to be efficiently carried out by the available staff.

PROGRAMME OF THE KASHMIR DEPARTMENT OF AGRICULTURE.

See Appendix C. page 64.

39. The Board considers that the varietal experiments in paragraph 1, section I, should be restricted to the more important crops of the State and should include only such as are likely to be easily improved by selection.

Mr. Sharma explained, in response to enquiries, that the "dal" soil referred to in paragraph 1, section 3, is the lake-bed silt, taken out and applied to the land.

Subject to the above restriction the Board accepts the Kashmir programme.

THE SCOPE OF IMPROVED POULTRY BREEDING IN INDIA.

40. The report of Sub-Committee (F) appointed to consider and report on the scope of improved poultry breeding in India was considered.

Mr. Dobbs enquired whether the Committee had considered the question of poultry breeding from the point of view of the fancier or as a commercial matter. The President replied that the latter was chiefly considered. Mr. Abbott remarked that he had expended at least Rs. 2,000 per annum in importing birds and had made it pay. Where a European can succeed there is much greater prospect of a native succeeding, as his difficulties in guarding against theft and other similar disadvantages are less.

Mr. Molony referred to the prejudices of Hindoos against poultry. If the question is taken up at Agricultural Stations it may interfere with the utility of the Station owing to these prejudices. Mr. Abbott said that even excluding Hindoos there was great scope for the work with Mahomedans, Parsees, Eurasians and others. Mr. Subba Rao stated that the prejudice against poultry only exists in the Brahmans amongst Hindoos. The Sudra caste and the lower castes are free from it.

The President said that if the work is to be attempted at all, it must be systematically and thoroughly taken up. A good trained Assistant will be required to carry out the experiments. A good Mahomedan would probably be the best class of man. Mr. Abbott considered that a special European Assistant such as a non-commissioned officer, who could be got for about Rs. 200 a month, should be appointed to supervise the experiments wherever they are being carried out to point out mistakes, select sites for runs and so on.

41. The Board adopts the report of Sub-Committee (F) as follows :—

Mr. Abbott, who has had long practical experience of poultry breeding in India gave much valuable information and stated that he had tested in India practically all breeds except Faverelles.

He considered that the following breeds were generally unsuited for India :—

- (i) Cochins, Brahmas and all breeds with heavily-feathered legs because they do very badly in the monsoon.
- (ii) Dorkings because they are too delicate.

He considered that the most suitable breeds for general utility purposes are :—

- (i) Plymouth Rocks—the best strain of these probably being the Barred Rock.
- (ii) Orpingtons of all strains.
- (iii) Wyandottes of all strains but probably Silver or White Wyandottes will be found best.

As regards the crossing of imported with indigenous breeds, the Sub-Committee has very little information but it is believed that the lighter laying breeds, especially the Minorcas and Leghorns, would be the most suitable imported breeds for a first cross and at a later stage Plymouth Rocks, Orpingtons and Wyandottes might be utilised to provide good table fowls. Mr. Abbott considers that the best of the native breeds for crossing purposes are :—

- (1) Hyderabad Black Games.
- (2) Penang Black Langshans.
- (3) Chittagong.

The Sub-Committee discussed the best means of obtaining well-bred birds for experimental work, and recognised the necessity of selection by a good judge when dealing with native breeds, as these are very often mixed and dealers often do not recognise the importance of selling for breeding purposes only birds of correct type. In introducing foreign breeds the only practicable way is to bring the birds, as the eggs are invariably bad after the sea voyage. The housing of poultry was next discussed and after pointing out the impracticability of a free range for the breeding stock owing to the loss caused by jackals, etc., it was decided that the method at

present in use at Pusa was the most suitable, but the runs though large in comparison with those used in Europe might with advantage be still larger. Growing chickens up to the age of four or five months can, on shaded grass land, run together in flocks (each flock not exceeding 100 birds) provided cockerels and pullets are kept separate. The position of breeding pens and of pens for young stock should be regularly changed and very frequently, if chicken cholera or other infectious disease occur. Absolute cleanliness and disinfection against disease, lice and such like, must always be secured. Defective ventilation in poultry houses is a frequent cause of death by heat apoplexy. This point always requires attention.

The feeding of fowls was next discussed and the Sub-Committee considers that many cheap Indian grains are very suitable. The best general food for grown fowls is crushed wheat or crushed oats, but where these are difficult to obtain or of prohibitive price, jowar, and the smaller millets will be found suitable. A mixture of the common small millets roughly crushed is well suited for growing chickens from 10 days to 6 weeks old. Maize is unsuitable in India as its effects are far too fattening; the importance of green food was insisted on and a regular supply of crushed green bone, broken kanker or broken shells and grit is essential. Bad water is a frequent cause of disease and a small quantity of Condly's fluid should be added to the drinking water before it is placed in the drinking troughs. In hot weather the water troughs should always be placed in the shade. The Sub-Committee then briefly touched upon the improvement of other classes of poultry.

Ducks.—Mr. Abbott stated that the Aylesbury breed is the most suitable as a pure breed and for crossing purposes in India. The Black and White Benares duck was the best indigenous Indian variety some years ago. The Sub-Committee recommends that the United Provinces Department be asked to make an enquiry as to the extent to which this breed now exists.

Geese.—It is known that geese of good type occur in India and that good breeds of the Chinese variety can readily be obtained in Calcutta. The Sub-Committee considered that good work can be done by selection and by crossing with European breeds particularly with the Embden variety.

Turkeys.—The Sub-Committee considers that local breeds can be greatly improved by crossing with the American-Bronze Turkey. This breed should also be maintained pure. Birds can best be obtained from Australia or England. These breeds in Australia are probably preferable for India.

Guinea Fowls.—Do not require much improvement as the present Indian breed is excellent in most respects.

The Sub-Committee then discussed the extent to which larger table birds and bigger eggs were likely to be in demand and whether the increase in prices necessitated by the increased cost of production could be realised.

The Sub-Committee recognised the difficulty experienced in most Indian towns in obtaining decent table fowls and believed that at least in the larger towns good fowls and large eggs would readily sell at profitable prices. Europeans and well-to-do Mahomedans and Parsees especially are anxious for poultry of better quality and are willing to pay any reasonable prices. Mr. Abbott estimated that a good cross-bred fowl would fetch Rs. 1-8-0 in the larger towns and considered that good eggs would easily repay the cost of production. The Sub-Committee recommends—

- (I) that the breeds indicated in this report as suitable for India should, in a practical way and on the lines suggested, be dealt with at Pusa.
- (II) that it is necessary to have a specially-trained assistant for the purpose.
- (III) that the chief object should be to provide a means of producing general utility fowls in India.
- (IV) that from Pusa selected birds should be distributed for pure breeding and for crossing.
- (V) that if the preliminary work at Pusa shows that poultry breeding on the above lines gives promise of becoming a remunerative industry, the work should be extended through all useful agencies in India, such as Provincial Agricultural Stations, Glass Farms, Missions, European Planters, Eurasians and well-to-do Parsees and Mahomedans.

THE LINES ON WHICH ENTOMOLOGICAL AND MYCOLOGICAL WORK IN THE PROVINCES SHOULD BE CONDUCTED.

42. The president opened the discussion of this subject by referring to the printed note (see Appendix D) containing his proposals for the expansion of different sections of the Provincial Departments of Agriculture. He suggested that the general question of the rates of pay and prospects required to attract the best sort of men to the Department should be first considered.

Dr. Mann held that the important point which the Board should consider is the possibility of suggesting an ultimate prospect of pay sufficient to attract the best men. The actual number required in each Province is immaterial at present. To obtain the type of men required for the upper subordinate posts in Agricultural Departments, it is necessary to offer prospects equal to those which obtain in other Government Departments.

Mr. Molony believed that the scale of pay must differ to some extent in the different Provinces. This is the case in most departments, and is due partly to difference in the cost of living. In the United Provinces the proposals are to form two divisions, a lower and an upper division. The latter is graded to make it about equivalent to appointments in the Revenue Service as Tahsildars. Five appointments are proposed at Rs. 125, five at Rs. 150, five at Rs. 175, four at Rs. 200 and four at Rs. 250. Among these if men of really first rate merit and administrative capacity should be found, they should have the prospect of becoming Assistant Directors on graded pay approximating to that of Deputy Collectors. Promotion from grade to grade in the upper division is by merit only, not by seniority. The Agricultural Department should at first offer terms a little better than those in the executive service, because being a new service it will carry less prestige.

Mr. Sly said that the present service in the Central Provinces is graded at from Rs. 50 to Rs. 250. In the short experience of this graded rate, it appears to be insufficient to attract the best men. The best solution is probably to have one general graded service so that any man in any section of the Department may rise to the highest scale of pay. This service should be approximately of the same standing, as regards pay and prospects, as the Revenue Service. There should further be an opportunity of nominating good men from the agricultural service to appointment as Deputy Collectors. He considered that the President's proposals are too definite, as the circumstances vary from Province to Province. In the Central Provinces a student passing into the service from college would begin on Rs. 50. If he is specially good he might pass at once to a higher grade. The ultimate prospect is the point to which the individual will look.

Mr. Hart agreed with Mr. Sly. In Eastern Bengal the higher grades would, if approximating to the Revenue service, be about from Rs. 200 to 800.

Mr. Hayman held that the pay should be somewhat better than that of Tahsildars to attract the same class of men. A subordinate in the Revenue Service is a great man in the village; an Agricultural Assistant will be at first at least a nobody.

Mr. Couchman thought that the Board is inclined to overlook the great competition in the Revenue Service and the very small proportion of men who ever rise even above Rs. 60. In Madras a large proportion of the Revenue Service serve a long apprenticeship on a pay of Rs. 15. Then they rise to Rs. 35. To the vast majority the ultimate scope of their highest ambition is to become a Tahsildar. He considered that for the present a maximum prospect of Rs. 250 would attract the best men. The student might spend a year on probation at Rs. 25 and then commence on Rs. 40 or Rs. 50. As a Farm Manager he will have a prospect of Rs. 50 to 100 at first and possibly Rs. 100 to 250 later on. Finally one or more Assistant Directors would be appointed on pay of Rs. 250 to 400.

Mr. Dobbs pointed out that the Agricultural Department ought to pay more than the Revenue Service, because their field of selection from the lower grades will be so limited that only good men should be taken into the Department from the start.

Mr. Renouf said that the present maximum pay in the Punjab was fixed at Rs. 300. This is probably too low and Rs. 500 might be better. The latter ultimate prospect should, however, be enough to get the right men, and there is, in his opinion, no need to equalise with the Revenue Department which is admittedly the

best in the Province. The scale proposed is Rs. 40 rising to Rs. 70, with further promotion to higher grades of from Rs. 80 to Rs. 120. The College Assistant Professor will get a maximum of Rs. 300.

Mr. MacKenna agreed with Mr. Sly's views since they merely equate the Agricultural Service to the Revenue Service and the actual pay will differ in different Provinces.

Mr. Gourlay considered that it will be necessary to offer definite prospects of high ultimate pay from the commencement, at least equal to those of the Provincial Executive Service.

Messrs. Knight and Bergthell gave specific instances from their recent experience of the difficulty of keeping promising men in the Department on the present prospects.

43. The Board considers that the present prospects in the Agricultural Department are insufficient to attract the right stamp of men for the upper subordinate posts, such as First Assistants, Assistants to Experts, Superintendents of Experimental Stations and the like. That the prospects for the upper subordinate staff should be somewhat better than those offered in the Provincial Executive Service in view of the fact that the service is new and specialised. The Board is not in a position to suggest the number of posts or particular grading required for each Province.

44. The specific question of the conduct of Entomological and Mycological work in the Provinces was next considered. The President referred the Board to the notes on this subject furnished by the Imperial Mycologist and the Imperial Entomologist (Appendix D).

Mr. Sly said that it is clear that under present conditions the research work in both these subjects must be done at Pusa. To assist the Pusa Experts it is probable that a small staff must be maintained in the Provinces. Similarly some staff is required to assist in the teaching of these subjects in Provincial Colleges. From the practical aspect he, however, disagreed with the notes submitted. Instead of having a specially-trained staff to do such field work in the checking of pests or diseases as may be required, he believed that this object will be most satisfactorily gained by using the regular staff of Agricultural Assistants. As regards the control of the men the Botanist may in some cases be the best man, but ordinarily the Deputy Directors should supervise the work of the fieldmen.

Dr. Butler expressed general agreement with Mr. Sly's views, except that in the case of the Assistant who would be concerned in teaching at the Agricultural College, he believed that he should form the part of the Botanist's staff. As regards the Field Assistants the opinion of Provincial officers appeared to be that the Deputy Directors could best control their work. He wished on further consideration and discussion with other officers to modify the staff suggested in his note as it appears probable that immediate requirements in most Provinces will be met by having one College Assistant for teaching, demonstration and cure of the collections, and one field assistant for general field work. A collector and mounter on small pay would complete the establishment.

Mr. Lefroy said that it will be impossible to work a scheme of practical work from Pusa. As he understood Mr. Sly's proposals, each Deputy Director would have one field assistant under his charge to assist the expert staff at Pusa. These men should, in his opinion, work up to one highly-trained Native Assistant Entomologist to the Provincial Department. Without this latter appointment Mr. Sly's scheme is incomplete. The latter should be on a pay of Rs. 250 to 500 and should control and co-ordinate the work of the rest of the staff. In cases of importance he should personally visit and advise on outbreaks of insect pests in any part of the Province. He would not be required for the teaching, since this, being elementary, could be conducted by a man of less high training. As regards the control of the staff he considered that it is immaterial under whom it should be placed.

Mr. Milne agreed with Dr. Butler that the Assistant concerned in teaching Mycology should be under the Botanist, since Mycology is merely a branch of Botany and the Botanist will always have some knowledge of it.

45. The Board is of opinion that the Provincial work in Mycology and Entomology should be limited to the employment of a special staff (1) to give assistance as is required for the research work to be conducted at Pusa and (2) for

the elementary training required at colleges. The practical field work for the prevention of pests and diseases should be undertaken by the ordinary staff of Agricultural Assistants. Further that the teaching in Mycology at Provincial Agricultural Colleges including any special staff required for the purpose should be under the control of the Provincial Botanist.

SIXTH DAY.

PROGRAMME OF THE IMPERIAL DEPARTMENT OF AGRICULTURE.

I.—AGRICULTURAL CHEMISTRY.

46. The Board adopts the recommendations of Sub-Committee (H), appointed to consider this programme, that the enquiry into feeding stuffs should be abandoned and that general analytical work for Provincial Departments and others should be excluded from the programme as they should properly be done by Provincial Agricultural Chemists.

47. The Board adopts the report of Sub-Committee (H) as follows :—

The criticism of the Advisory Committee of the Royal Society of London on the Agricultural Chemistry Programme in the Economic and Industrial Chemistry Section of the Report of the Board of Scientific Advice, 1905-06, was generally discussed.

The Sub-Committee considers that investigations of general problems which can be made as well or better elsewhere should not be taken up in India except in so far as is necessary for the investigation of problems which are of particular reference to Indian Agriculture. It recognises that full advantage should be taken of investigations made elsewhere, and their application to conditions of sub-tropical agriculture is an important aspect of the Indian problem.

The items in the programme were discussed *seriatim*.

Available plant food in soils.—With regard to the general question of the desirability of carrying on investigations into the determination of the available constituents of soil, the Committee considers that the study of plant nutrition is of importance in India; the question of availability of plant food is an essential part of that study in India as elsewhere. The application of existing methods of investigation must in the earlier stages be examined with special reference to Indian conditions.

An attempt is now being made at Pusa to determine what is the actual chemical and physical state of certain constituents of important Indian soils and the effect of some of these constituents on the others both during periods of fallow and when the land is occupied by crops.

The Sub-Committee believes that this line of work may lead to useful results.

Gases in soils.—The Sub-Committee considers that this investigation is an essential portion of the problem referred to above, and that it has special significance in regard to Indian conditions and should be continued.

The testing of calcium cyanamide and calcium nitrate as manures.—The testing of these manures was undertaken at the specific request of commercial firms who are prepared to undertake the manufacture on a large scale, provided the Agricultural Department could establish their utility. If the tests are successful there is every prospect that these materials will be manufactured in India on a commercial scale.

The Sub-Committee therefore considers that the tests should certainly be continued.

The composition of field and garden crops.—The Sub-Committee entirely agrees that the ultimate analysis of crops with the object of obtaining definite information with regard to their manurial requirements is not likely to lead to important results and should not be included in the programme of Agricultural Chemistry. This item was inserted without any reference to Dr. Leather.

Water in soils.—The Sub-Committee considers that this investigation is of particular importance in India, and will have an important application in solving the problem as to how much water various crops require; it should, therefore, be continued.

Cyanogenic glucosides.—The Sub-Committee considers that this investigation should be looked upon as of minor importance.

Feeding stuffs.—The Sub-Committee considers that this item should be eliminated from the programme.

General analytical work.—As each Province has now an Agricultural Chemist, this item should be excluded from the Imperial Agricultural Chemist's programme.

Training.—This subject has been dealt with by the Sub-Committee (G).

In addition to the above the Sub-Committee considers that the chemical investigations connected with the permanent field experiments at Pusa should be included in the programme.

II.—ECONOMIC BOTANY.

48. Dr. Mann desired the opinion of some of the Botanical members of the Board on the advisability of conducting investigations regarding the agricultural value of races of cultivated crops in any one locality, where these investigations are intended to apply to the whole of India. It appears to be still a moot question whether the characters of a plant do not undergo a certain amount of change when it is transferred to a new locality, especially if outside the natural area of the plant. Captain Gage said that from the botanical standpoint there appears to be no reason to doubt that the more important characters at least will be brought out wherever the work is done. It is not possible to talk of the natural area of a large number of important crops, as the origin of these is often only a subject for speculation. Mr. Gammie agreed with Captain Gage on both points and could see no reason why work of this sort should not be done at Pusa. Mr. Howard said that in any case there is no evidence available to permit of a full discussion and it appears better to await such evidence.

49. Mr. Sly enquired whether it is proposed to continue cotton work at Pusa. The President explained that this work had been started at Pusa because there appeared at one time a prospect of extending cotton cultivation in Behar. This prospect had not been realised and there seems to be no advantage in keeping it, except so far as it would help Mr. Gammie in his work. Mr. Howard said that all that is now proposed is to grow a series of types for students' information.

50. The Board accepts the programme of the Imperial Economic Botanist.

III.—MYCOLOGY.

51. The Board accepts the programme of the Imperial Mycologist and further desires to add that the work in Systematic Mycology, mentioned in the programme, must for the present be done at Pusa in the absence of any other agency in India for the purpose.

IV.—ENTOMOLOGY.

52. At Mr. Hart's request, Mr. Lefroy promised to arrange for a local enquiry into some important insect pests of paddy in Assam, should an outbreak be notified this year. Two other enquiries into important pests will probably be taken up if opportunity arises—the *surul* pest of ground-nut, and pests of stored potatoes. Mr. Henderson enquired to what stage the treatment of the boll-worm epidemic in cotton in Sind has advanced. Mr. Lefroy replied that experience both in the Punjab and Sind points to the re-introduction of the boll-worm parasite as having restored normal conditions. The parasite was introduced in Sind last year with a resulting better crop. The treatment is now beyond the experimental stage and full details will be published.

53. Mr. MacKenna said that lac appears to be a question for the Forest Department and not the Agricultural Department to deal with, so far as Provinces are concerned. Several other members agreed with this opinion.

54. The Board accepts the programme of the Imperial Entomologist and the Second Imperial Entomologist.

V.—BACTERIOLOGY.

Mr. Berthel stated that he intentionally drew up as broad and general a programme as possible since he cannot decide, until work is actually commenced at Pusa, what items of the programme can be immediately taken up. The

programme is an outline of work which must necessarily require many years to complete.

55. The Board accepts the programme of the Imperial Bacteriologist.

VI.—AGRICULTURE.

The report of Sub-Committee (C) appointed to consider the programme of the Imperial Agriculturist was considered.

56. Mr. Shearer explained that the proposed permanent wheat and maize manurial series appended to the report has been prepared on the plan of the Rothamsted permanent manurial wheat plots, but as the Sub-Committee has not expressed a definite opinion regarding it, he desired the opinion of the Board whether it should be retained. After some discussion it was agreed to withdraw this series from the programme.

57. Mr. Clarke enquired how far it is intended to carry the work on sugarcane referred to in paragraph 3 of the programme. He considered that this work, especially that portion of it referring to selection, can only be useful if carried out on a large scale and regarded as work of the first importance. Mr. Howard pointed out that the matter was very fully discussed at Cawnpore last year and it was recommended to confine extensive sugarcane work to a very small number of stations. At Pusa there is no intention at present of undertaking extensive work. It is a minor question and, so far as it is confined to securing a good cane for local growing, there is no reason why it should interfere with other more important work. Dr. Mann held that it should be taken up at Pusa on a large scale and made a principal feature of the programme. Mr. Sly disagreed. Pusa is in a tract which is not at present an important sugarcane growing one, and so far as he could see, there are none of the local conditions referred to in last year's discussion which would justify work on a large scale.

58. Mr. Shearer explained that indigo will be grown in rotation with flax, as mentioned in paragraph 4, on the advice of the Flax Expert employed by the Bengal Government. Mr. Bergtheil enquired if improvement by selection will be attempted with both crops. The President stated that if the Indigo Research Station at Sirsah be kept on by the Bengal Government, selection of this crop should be done there and not at Pusa.

59. The President explained that there is a prospect of securing assistance in the tobacco curing experiments, mentioned in paragraph 5 of the programme, from an American Tobacco Expert from Monghyr. Unless such assistance can be secured it is doubtful if any work can be attempted at present.

60. Mr. Shearer explained that the varietal work mentioned in paragraph 8 with wheat, rice, maize, opium and castor, was intended to be merely preliminary to other work, should need arise for this. Dr. Mann held that such work should include plant to plant selection. Mr. Shearer and Mr. Howard agreed to this. The Board accepts the remainder of the programme.

VII.—PROGRAMME OF THE IMPERIAL COTTON SPECIALIST.

61. Mr. Gamnie stated that he has as yet no definite proposals to make, owing to the recent date of his appointment. Details of work will be arranged in consultation with the Provincial officers. He has arranged to tour in Madras in March and to visit the Central Provinces and Eastern Bengal and Assam probably in November. It will only be possible to visit a portion of the cotton growing tracts this year owing to lack of time.

METHODS OF BRINGING EXPERIMENTAL WORK TO THE NOTICE OF CULTIVATORS.

The report of Sub-Committee (D) was considered.

62. The President invited suggestions regarding the publication of the report which, he considered, should be more widely distributed than can be secured in the published Proceedings of the Board. Several members agreed and offered suggestions.

63. The Board recommends that report of Sub-committee (D) be separately printed in pamphlet form and distributed to all District Officers in India, to

Cyanogenetic glucosides.—The Sub-Committee considers that this investigation should be looked upon as of minor importance.

Feeding stuffs.—The Sub-Committee considers that this item should be eliminated from the programme.

General analytical work.—As each Province has now an Agricultural Chemist, this item should be excluded from the Imperial Agricultural Chemist's programme.

Training.—This subject has been dealt with by the Sub-Committee (G).
In addition to the above the Sub-Committee considers that the chemical investigations connected with the permanent field experiments at Pusa should be included in the programme.

II.—ECONOMIC BOTANY.

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III.—MYCOLOGY.

51. The Board accepts the programme of the Imperial Mycologist and further desires to add that the work in Systematic Mycology, mentioned in the programme, must for the present be done at Pusa in the absence of any other agency in India for the purpose.

IV.—ENTOMOLOGY.

52. At Mr. Hart's request, Mr. Lefroy promised to arrange for a local enquiry into some important insect pests of paddy in Assam, should an outbreak be notified this year. Two other enquiries into important pests will probably be taken up if opportunity arises—the *surul* pest of ground-nut, and pests of stored potatoes. Mr. Henderson enquired to what stage the treatment of the boll-worm epidemic in cotton in Sind has advanced. Mr. Lefroy replied that experience both in the Punjab and Sind points to the re-introduction of the boll-worm parasite as having restored normal conditions. The parasite was introduced in Sind last year with a resulting better crop. The treatment is now beyond the experimental stage and full details will be published.

53. Mr. MacKenna said that lac appears to be a question for the Forest Department and not the Agricultural Department to deal with, so far as Provinces are concerned. Several other members agreed with this opinion.

54. The Board accepts the programme of the Imperial Entomologist and the Second Imperial Entomologist.

V.—BACTERIOLOGY.

Mr. Bergtheil stated that he intentionally drew up as broad and general a programme as possible since he cannot decide until work is actually commenced at Pusa, what items of the programme can be immediately taken up. The

programme is an outline of work which must necessarily require many years to complete.

55. The Board accepts the programme of the Imperial Bacteriologist.

VI.—AGRICULTURE.

The report of Sub-Committee (C) appointed to consider the programme of the Imperial Agriculturist was considered.

56. Mr. Shearer explained that the proposed permanent wheat and maize manurial series appended to the report has been prepared on the plan of the Rothamsted permanent manurial wheat plots, but as the Sub-Committee has not expressed a definite opinion regarding it, he desired the opinion of the Board whether it should be retained. After some discussion it was agreed to withdraw this series from the programme.

57. Mr. Clarke enquired how far it is intended to carry the work on sugarcane referred to in paragraph 3 of the programme. He considered that this work, especially that portion of it referring to selection, can only be useful if carried out on a large scale and regarded as work of the first importance. Mr. Howard pointed out that the matter was very fully discussed at Cawnpore last year and it was recommended to confine extensive sugarcane work to a very small number of stations. At Pusa there is no intention at present of undertaking extensive work. It is a minor question and, so far as it is confined to securing a good cane for local growing, there is no reason why it should interfere with other more important work. Dr. Mann held that it should be taken up at Pusa on a large scale and made a principal feature of the programme. Mr. Sly disagreed. Pusa is in a tract which is not at present an important sugarcane growing one, and so far as he could see, there are none of the local conditions referred to in last year's discussion which would justify work on a large scale.

58. Mr. Shearer explained that indigo will be grown in rotation with flax, as mentioned in paragraph 4, on the advice of the Flax Expert employed by the Bengal Government. Mr. Bergthell enquired if improvement by selection will be attempted with both crops. The President stated that if the Indigo Research Station at Sirseah be kept on by the Bengal Government, selection of this crop should be done there and not at Pusa.

59. The President explained that there is a prospect of securing assistance in the tobacco curing experiments, mentioned in paragraph 5 of the programme, from an American Tobacco Expert from Monghyr. Unless such assistance can be secured it is doubtful if any work can be attempted at present.

60. Mr. Shearer explained that the varietal work mentioned in paragraph 8 with wheat, rice, maize, opium and castor, was intended to be merely preliminary to other work, should need arise for this. Dr. Mann held that such work should include plant to plant selection. Mr. Shearer and Mr. Howard agreed to this. The Board accepts the remainder of the programme.

VII.—PROGRAMME OF THE IMPERIAL COTTON SPECIALIST.

61. Mr. Gammie stated that he has as yet no definite proposals to make, owing to the recent date of his appointment. Details of work will be arranged in consultation with the Provincial officers. He has arranged to tour in Madras in March and to visit the Central Provinces and Eastern Bengal and Assam probably in November. It will only be possible to visit a portion of the cotton growing tracts this year owing to lack of time.

METHODS OF BRINGING EXPERIMENTAL WORK TO THE NOTICE OF CULTIVATORS.

The report of Sub-Committee (D) was considered.

62. The President invited suggestions regarding the publication of the report which, he considered, should be more widely distributed than can be secured in the published Proceedings of the Board. Several members agreed and offered suggestions.

63. The Board recommends that report of Sub-committee (D) be separately printed in pamphlet form and distributed to all District Officers in India, to

the Press and to others interested in the subject. Several members gave specific instances of means of disseminating agricultural improvements and getting into touch with cultivators not included in the report.

64. The Board desires that specific instances mentioned by various members, of the means of bringing the work of agricultural departments home to cultivators, other than those noted in the report, be incorporated in the latter by the President and that the report thus amplified be again referred to the members of Sub-Committee (D) for revision, prior to publication in separate form.

65. Mr. Howard considered that some of the agencies for securing the dissemination of agricultural improvements mentioned in the report, such as vernacular publications are of minor value, and that sufficient stress has not been laid on the all-important agency of example. In Java where the problems of agricultural improvement approximate to those in India, everything is subordinated to the work of demonstration. The experiment stations are few and good and in connection with these a system of travelling farms or gardens has been developed and the work of the stations is thus brought home to the cultivators in every district by actual demonstration. Mr. Milligan held that it is dangerous to over-emphasise any one line of work in this connection at the expense of other lines which may be of special value in some places. Mr. MacKenna and Mr. Couchman agreed with Mr. Milligan and gave instances where the publication of vernacular leaflets has been of considerable utility.

66. The Board recommends that the subject of the best means of bringing the results of experimental work to the notice of cultivators shall be included in its programme in each succeeding year in the immediate future. Details should be furnished each year of the methods adopted in the different Provinces and their results, so that officers of the Department and others should know what has been and is being done, year by year, in this matter.

67. The Board adopts the report of Sub-Committee (D), as follows :—

The Sub-Committee desires to acknowledge that much valuable information has been obtained from the note submitted by Mr. Clouston on the introduction of improvements into Indian Agriculture.*

The Sub-Committee has considered in succession the methods which have been suggested for bringing experimental work to the notice of cultivators. It is convinced that it is impossible to lay down any general system which is universally applicable, as the conditions are too diverse for methods to be equally useful in all Provinces or even in all localities in a Province. It proposes, however, to consider the means which have been employed in the various Provinces, and which have proved a success, and also to indicate the conditions which appear to lead to success or failure in each case.

Agricultural Associations.—The formation of local Associations for agricultural improvements has been one of the most common methods of increasing interest in the subject. It has been successful in some cases and more especially in the Central Provinces. On the other hand the success has by no means been universal.

In the Central Provinces, the local Agricultural Association is most directly connected with the Agricultural Department of the Province. The district is taken as a unit and the Collector is Chairman of the Association. The influence and co-operation of the district officers is considered to be an essential condition of success. It is held that the Associations must be in close touch with the superior officers of the Agricultural Department one of whom always attends the meeting of the Association. The meetings are held half yearly before the opening of the *kharij* and the *rabi* seasons, and the Director and Deputy Directors devote some months each year at these times to going from meeting to meeting. Thus they know the members personally. The members are limited in number, and consist chiefly or almost entirely of substantial agriculturists, owners of villages who are also cultivators, heads of sub-divisions of cultivating castes and the like,—and the members undertake to carry out a demonstration of an improvement suggested by the Department. In this they are assisted with seed, implements, or other materials needed for the purpose, and their work is inspected by the Superintendent of the nearest farm or other member of the Departmental staff. At every

*In accordance with the recommendation of Sub-committee (B) (see page 6) this note has not been included in the proceedings but will be published elsewhere.

meeting an actual programme of work is submitted, criticised by the members, modified, if necessary, and the several pieces of demonstration allotted to the members. At the meetings the method of lecturing without any actual programme of work is being given up. In the programme no piece of work is recommended by the Agricultural Department, unless it has been proved by the Department itself to be likely to succeed. Two meetings such as have been described are held annually and though the people clamour for more, it is considered advisable not to add to the number. The time of holding these meetings depends on the system of cropping.

These Associations have been largely instrumental in introducing superior varieties of *tur*, of *gowar* and of sugarcane, and the adoption of improved implements. The greatest advantage is, however, felt to be that they bring the Department into close touch with the best cultivators in each district.

In Madras, the development of Agricultural Associations has taken a more independent line. They are officially patronised but are independent bodies. They usually take the district as the unit, but branch associations are formed in smaller areas. Their utility generally depends on the activity of local men, generally educated men and often substantial land-holders. They have in the deltaic areas been the means of introducing the system of transplanting single seedlings in rice cultivation. Elsewhere they have brought into practice improvements in manure conservation; they have caused the use of the process of green manuring with wild indigo after paddy to be adopted in the Tanjore district, and have introduced iron ploughs. They have been instrumental in extending the cultivation of paddy in Tinnevely, jute in Tanjore and Malabar, and ground-nut in Malabar and South Kanara. They have, however, not been in existence long enough for a definite opinion to be formed of their general utility. There is a Central Agricultural Committee in Madras which forms a link between the various local Associations.

In Bombay there has been comparatively little development on this line, but three District and a number of Taluka Associations exist. They are always independent bodies and often combine in their functions other purposes as well as those of agricultural improvement. The two most active and successful are in Dharwar (a District Association) and in the Sangamner Taluka of the Ahmednagar District. In each case they depend largely for their success on the personal influence of an active local man, and they only have official patronage. In Dharwar the Association has been instrumental in bringing about the extension of the cultivation of Broach cotton in the district, the more careful selection of Dharwar-American cotton seed, and the adoption of the Turnwrest plough. In Sangamner the Association organizes an exceedingly important local agricultural show subsidised by the Agricultural Department and has introduced improved varieties of wheat. It has led to the establishment of a grain bank, while breeding bulls have been introduced as a result of its operations. Many of the Bombay Associations are continually asking for demonstration to undertake; and the difficulty has been and is now to find matters of proved value for them to try.

In Bengal a Provincial Agricultural Association and Divisional and District Associations have recently been formed but it is too early to say what their effect has been. These Associations are largely composed of townsmen, pleaders and Zamindars not themselves cultivators. In fact cultivators' holdings are generally so small that it is considered unlikely that Agricultural Associations on the model of those in the Central Provinces are likely to succeed.

The utility of Agricultural Associations seems to depend largely on the presence of a body of substantial men who are also cultivators, on the *personal* touch of the higher staff of the Agricultural Department with the members, on the definite engagement by the members to do definite pieces of work, and on the regularity of meetings, inspections and reports. In other matters conditions will vary with the districts. It may and will be advisable to have smaller associations than those of a district in some instances. If such smaller associations can be sufficiently substantial and intelligent, the Sub-Committee considers that they should be encouraged.

Demonstration Farms.—Demonstration farms have in some cases had considerable success in Bombay and in the Central Provinces in bringing improved methods to the notice of cultivators and in securing their adoption, but as such, they have not been used to any extent elsewhere. In the Central Provinces, the

system adopted is as follows. In the first place experiment is rigidly separated from demonstration. Nothing is tried in a demonstration farm which, in the opinion of the officers of the Department, is not actually of proved value for the tract in question, and each demonstration farm has a definite purpose in view. A varying amount of land is taken, which should not be greater than the particular purpose demands and the assistant in charge can efficiently manage; a small area carefully cultivated is much better than a larger area inefficiently managed. The occupation of the land is purely temporary. It is lent to the Department by an annual arrangement and the cultivator to whom the land belongs is guaranteed against loss. He is given also a large share or even the whole of the profits. The plots are selected by the Deputy Director or one of the senior officers of the Department. No difficulty has been found in inducing a cultivator to lend a suitable piece of land. An assistant is then placed in charge specially trained in the particular problem to be demonstrated. Local methods entirely must then be adopted in working the land except as regards the particular point to be demonstrated. The demonstration plot is visited at frequent intervals by the senior assistant of the Department who is also the Superintendent of the experimental farm for that particular tract, and who has a special interest in the success of the demonstration. The assistant in charge sends a weekly diary to the Deputy Director through the Superintendent of the Farm. The final success of the demonstration is judged by the general adoption of the method recommended and demonstrated.

The chief difficulties have been in obtaining suitable men to put in charge of the demonstration and in securing adequate supervision. The assistants placed in charge must be themselves agriculturists and generally they are men who have passed through the Agricultural College.

The demonstrations have proved very successful in the Chhattisgarh District (where rice is as a rule sown broadcast) in bringing the methods of transplanting rice into general practice, in showing how to use irrigation water most economically and effectively, and in showing how to grow additional crops after early rice instead of the present plan of leaving the land bare.

The Sub-Committee considers that there is considerable promise of demonstration farms conducted on lines similar to those followed in the Central Provinces proving useful in other Provinces.

Village Agencies.—It has always been a problem of considerable difficulty to get improved implements of undoubted value adopted by the cultivators, but the institution of village agencies as devised in the United Provinces promises success. These are managed by a local agent with whom implements are placed and from whom they can be hired out or sold. Before the agency is established, the particular implement is always demonstrated carefully to cultivators at the agency. An agricultural assistant then from time to time visits such agencies, accompanied by a *mistri* who can repair the implements, and inspects, gets machines repaired if necessary, visits the cultivators who have adopted them, and ascertains whether they are working satisfactorily. A register is kept of all those who buy the implements and the Deputy Director sends out an occasional note enquiring whether customers are satisfied.

Various implements, but perhaps most notably pumps have been distributed by this means and the methods seem to get over the difficulty felt in Bombay and elsewhere that new machines are not adopted largely because of the difficulty of repair.

In this connection, it may be noted that a number of cultivators in one of the Canal Colonies of the Punjab (Lyallpur) are this year obtaining reapers on the recommendation of and through the Agricultural Department. About 50 reapers have been supplied. A class for *mistris* has been formed in connection with the Lyallpur farm and these men are trained in the use and repair of the machines. The Sub-Committee would urge the necessity, in this and similar cases, of taking advantage of the experience in the United Provinces, and securing the keeping in order of the machines for some years.

Vernacular Agricultural Journals.—Vernacular Journals have been established in several parts of India.

In the United Provinces, a monthly vernacular paper of six to ten pages edited by the head clerk of the Agricultural Department, is published. It has not been

so successful as it might be made by more careful editing and the appointment of a separate editor is under consideration. It may be considered as principally an attempt to bring the work and aims of the Department to the notice of the cultivators.

In the Central Provinces there is a monthly Departmental vernacular paper. It has been found that to be really useful, it must be very carefully edited, up to date, thoroughly practical, and deal with the immediate needs and interests of the cultivators. The translation into the vernacular must be carefully made by a man who is himself connected with the land. The paper usually contains very popular statements of the work of the experimental stations, with practical directions to enable the cultivators to apply them to their own circumstances. It contains also a "query and answer" column in which the readers are encouraged to ask the Department for advice. It also furnishes a means of advertising improved strains of seed, agricultural machinery and other things for sale at the stations. It consists of about 15 to 20 pages, is published in three languages and has a circulation of 2,500.

In Madras, no vernacular paper is issued by the Department. The Agricultural Department patronises two privately owned agricultural publications.

In Bombay there are three private vernacular agricultural journals, all of which are patronised by the Department. The Department subscribes for a number of copies and contributes articles and plates.

The Sub-Committee considers that where vernacular agricultural journals privately owned and worthy of support already exist, it is wiser to encourage and contribute to these rather than to start a Departmental publication. In many cases it thinks considerable good can be done by vernacular journals, provided they are well edited.

In this connection the Sub-Committee wishes to state its opinion that any journal published by Provincial Departments should be designed to meet the requirements of the cultivators and land owners. They should be essentially vernacular publications, with possibly an English edition. To meet the higher English speaking strata the Agricultural Journal of India published from Pusa should be the only medium.

Leaflets and Circulars.—Leaflets have been published in several Provinces giving information as to the results of experiments and recommendations as to methods to be adopted.

In Bengal a regular series of such leaflets is issued both in English and the vernacular, and they are distributed through agricultural associations but it is too early to draw any conclusions concerning their effect.

In Madras agricultural leaflets have been published in the vernacular in the District Gazettes. So far the effect has not been traceable. The introduction of *Banlu* paddy into a large area is partly due to information thus published. As a result of a leaflet widely circulated in Godavari, no compensation has been demanded for palm trees destroyed in the palm disease operations although some 200,000 trees have been killed.

In the Central Provinces the issue of leaflets has been suspended and such information is published in the journal of the Department which is a better medium. Both in the Central Provinces and in Bombay printed directions in the vernacular are issued, when new seed, new manures, etc., are distributed.

In general the Sub-Committee desires to express its agreement with the resolution of the Board of Agriculture in 1905 that leaflets "to be successful in reaching their object should be brief, perhaps not exceeding a couple of pages, and should contain one definite fact or the description of a single process which it is desirable that the ryot should know or adopt."

Utilization of General Vernacular Press.—At present, in the Central Provinces and Madras no use is made of the general vernacular press for the dissemination of agricultural information, while in Bengal it is only utilised in connection with Co-operative Credit Societies. On the other hand in Bombay considerable advantage has been taken of the press in the past, and matter is freely taken. In the Punjab a press communique is issued once a month to the leading English and vernacular papers and is considered to have been distinctly successful where it is

confined to information on established successes. In 1906-07 it was successfully used to bring to the notice of the cultivator remedial measures to check boll-worms.

The Sub-Committee considers that where the local press has a wide circulation it should be recognised as being a possible medium of reaching the cultivators, more particularly where there is no local agricultural paper with a wide circulation.

Agricultural Shows and Exhibitions.—An attempt has been made to utilize Agricultural Shows in nearly all Provinces, but with very varying success. In the United Provinces the attempts have been neither very successful nor popular. Lately, however, there has been an improvement in the method of carrying out the shows. In Bundelkhand, cattle shows lasting one day only, at which substantial prizes are given, have met with success.

In the Central Provinces, agricultural shows have only recently been developed. It is considered essential that one of the leading members of the Departmental staff should be present. It is thought that thus conducted the Department is brought in contact with a class of cultivators who cannot otherwise be reached easily. By combining popular lectures on the exhibits with practical demonstrations of each, much good work is thought to be done. The lecturer carries with him a small travelling case of exhibits to illustrate his lectures. The Superintendent of the Experimental Farm is usually the lecturer, and he is supplied with his lecture from head-quarters.

In Bombay, the use of special shows and exhibitions is new and dates from the Bombay exhibition of 1904. Nearly 500 selected cultivators were taken to that show, the exhibits were demonstrated in four languages and as a result there has been an increased sale of improved implements, and enquiries to the Department have much increased since this time. Since 1904 exhibits have been arranged at Surat, Ahmedabad and Satara, in each case as part of an exhibition arranged by a non-official committee, and similar arrangements were made for instructing cultivators. A good deal of success has followed the organization of a regular agricultural show at Ahmednagar. Here Taluka committees presided over by the Mamlatdar were formed beforehand. Every exhibit was certified as a man's own production by the village officer and in the case of grain a sheaf in addition to the sample was exhibited, while similar methods were adopted with other materials. The prizes were substantial. An attempt to give prizes for standing crops did not meet with great success. The Departmental exhibits, such as "well-jumpers," Ransomes iron plough, etc., were shown in actual operation. Among cattle, prizes were given for the progeny of bulls introduced by the Department. A similar show is being organised in the same district by the Sangamner Taluka Association, with the help of the Department, which is freely given. So far the cultivators are very keen to send their exhibits and great interest is taken in the competitions.

Some successful efforts have been made to hold cattle shows in Madras in recent years, but so far the actual effect on the agriculture of the district is hardly traceable. Local festivals are frequently made use of in popularizing agricultural improvements.

In the United Provinces meetings for the grant of Takavi advances have been made use of to bring agricultural improvements to the notice of cultivators.

The Sub-Committee is of opinion that agricultural shows should usually form a means of bringing matters of importance to the notice of the agricultural classes. It is felt, however, that while local effort may arrange the show, the part taken by the Agricultural Department should be very carefully organised, and attended to by one of the superior staff of the Department. Every effort should be made to make the exhibits in such shows actual specimens of the cultivators' production. It should be remembered too, that a show to be successful must be essentially popular.

Itinerant Assistants.—In Bombay, some of the senior assistants of the Department have been employed in travelling in the districts to introduce new varieties of seed. Large quantities of Broach cotton and of better varieties of groundnut have been sold to cultivators by this means and reports of success have been collected by the same agency.

In the Central Provinces similar means have been adopted successfully to introduce new implements but not for other purposes.

In Madras, assistants employed in going from place to place have secured the adoption of improved sugarcanes in many cases, as well as of better types of ground-nuts.

In the United Provinces itinerant assistants have been employed to spread the use of new seed and implements.

In Bengal travelling Inspectors have been appointed comparatively recently.

On the whole the Sub-Committee thinks that especially for the introduction of new implements which can be demonstrated by travelling assistants and for that of new seed, itinerant inspectors are of great value. It considers, however, that men so employed, should, for each journey, have a definite object in view. It does not approve of mere travelling assistants without specific duties.

In the same connection mention may be made of the Divisional Inspectors recently appointed by the Bombay Department. Their function is to work in the districts, with the experimental farms as head-quarters, with the object of bringing the Department into touch with the agriculturists. The men so employed are among the best in the Department, are practical agriculturists themselves, and are chosen because of their capacity to obtain the confidence of the cultivators.

Seed Farms.—In Bengal two successful jute seed farms have been established and these have been able to spread selected jute seed over the country. The seed is in strong demand among the growers.

In the Central Provinces seed farms and seed selection have had considerable success. Farms for the supply of selected cotton seed have been established in special tracts, and the cultivators have already imitated them in giving more attention than is usual to the cultivation of the plots intended for seed, to the spacing of the plants, to selection of seed, and to the ginning of the cotton.

In Madras, seed farms have been established for cotton while in the Punjab large quantities of Dharwar American cotton have been grown and distributed. In the latter case agricultural assistants have also toured in the villages regularly, and arrangements have been made to secure a higher price for the improved staple.

On the whole the Sub-Committee considers it has been proved that the general demand for good and pure seed is undoubtedly considerable. If the Departments can establish seed farms, it should be considered as a really good line of work particularly in places which have a local reputation for the production of seed of a superior quality.

Seed Depôts.—In the United Provinces great success has been attained in the spreading of the superior Muzaffernagar white wheat by the use of seed depôts where sale is effected on credit. This system continues to increase greatly in popularity and extension is limited only by the difficulty of providing responsible supervision. The amount of seed so issued in 1906-07 amounted to over 10,000 maunds. The successful restocking of Bundelkhand after the last great famine indicates a line of work that can be usefully followed under similar conditions.

In Bengal, a depôt has been established where a variety of useful seeds can be obtained. Here the quantity of seed available for a single buyer is limited. Almost all the sales are to members of the various local agricultural associations. This depôt seems likely to be very useful.

In Madras, a depôt for cotton seed was maintained at Bellary for several seasons, but has now been closed. There is also a depôt for ground-nut seed at Palur. A great demand for good seed always exists.

The Sub-Committee feels that the establishment of seed depôts is likely to lead to excellent results, provided that only the very best seeds are obtained and sold. A single distribution of inferior seed, by accident or carelessness, is likely to lead to great damage to the Department and should be avoided at any cost.

Importation of Cultivators from district to district.—Two or three cases have been brought before the Sub-Committee where great improvement in local practice has been obtained, by the introduction of cultivators from one district to another. These were the bringing of men to Cawnpore and to Nagpur, to work land treated with night soil and poudrette. In both cases success was ultimately achieved and

the local cultivators have followed the improved methods. A case of failure of a similar method in the Chingleput District of Madras was, however, noted.

In the opinion of the Sub-Committee this is a method which should be considered. It may be possibly applicable in connection with the introduction into Sind of the improved methods of cultivation demanded by Egyptian cotton.

Allied to this, is the method of sending a gang of sugar boilers from the Poona district round the Bombay Presidency (even to Sind) and to the Central Provinces to show better methods for preparing *gur* from sugarcane.

This has been fairly successful in many centres.

Short courses for Cultivators at Experimental Farms.—The only Department which has adopted the system of having short courses of instruction in specific subjects at the experimental farms, is that of Bombay. Here, hitherto, courses limited to a few weeks only, in cotton seed selection have been given on the Surat Farm. It is now, however, proposed to extend these courses considerably. The use of new implements and machinery; better methods of dairying in Guzarat; methods of dealing with sugarcane and several other courses will shortly be taken up.

The Sub-Committee considers this method is worthy of more extended trial if cultivators can be induced to go to the farms for the purpose.

In Bombay too the sons of ryots are taken for two year courses on some of the farms. This is rendered possible by the provision of the funds by a Bombay gentleman for the purpose. In the United Provinces, an offer is made to teach and train labourers if these are sent to the farms. Wages are paid, but not many usually avail themselves of the opportunity. Demand exists for similar facilities in the Central Provinces, but only from Missionary Schools.

The Sub-Committee feels that with suitable precautions such training may be a method of considerable advantage.

Amongst the general operations of Departments which have been instrumental in popularizing them amongst the cultivators, the well-boring work in the United Provinces requires special mention: 180 new wells have been bored and in 117 existing wells the supply of water has been increased. The success attending these operations has been of the greatest value in inclining the people to rely on the assistance of the Department in agricultural matters generally. Not alone in questions of water supply but in other matters, the advice of the Department is freely accepted in many localities where the well-boring work has brought the people into touch with its officers.

Before proceeding to draw general conclusions on the subject referred to it, the Sub-Committee wishes to draw attention to the financial aspect of the introduction of agricultural improvements by the Indian cultivators. It is impossible to estimate the value of any method to a cultivator unless account be taken of his financial conditions. In the past it doubts whether this has been done sufficiently. Ideas of a ryot's financial condition have often been very vague. It is probable that in many parts of India a cultivator does not have any ready capital. He has to borrow every year for the purpose of meeting the expense of cultivation, and the rates of interest which he has to pay in some Provinces are often from 25 to 75 per cent. per annum. It is therefore not sufficient that an expert in agriculture can prove to himself that a new method will give a return of 10 to 20 per cent. over the old method before the experiment is of "proved value." Account must also be taken of the extra capital involved and the rate of interest which the agriculturist will have to pay for this.

As the cultivator has no capital, he takes no risks. Unless we can show that the new method is a certainty, the cultivator will not take it up. A certainty will mean, as a rule, to a ryot something which will give him a return of over 25 per cent. improvement on the extra capital invested. The Indian cultivator is not nearly so conservative as is often supposed, but is quick to see any advantage, but there must be no risk, and he must be able to pay for the capital from the results of the new method.

The Sub-Committee is anxious to emphasise the connection between agricultural improvement and the extension of cheap credit, and hence the close connection and

collaboration which should exist between the Department and the Co-operative Credit organization. The latter is often in the opinion of the Sub-Committee the best possible introduction to agricultural improvement. Improvement of agriculture by co-operation and Co-operative Credit Societies have gone hand in hand in the principal agricultural countries on the continent of Europe.

General.—It remains now to summarise the general conclusions to which the Sub-Committee have come on the questions referred to it. It considers that among all the methods the utility of which it has examined, each is adapted to special conditions. It seems certain that if a really good improvement can be presented to the Indian agriculturist he is ready to take it up. The conservatism of the cultivators is generally exaggerated.

The winning of the confidence of the cultivators is the first condition of success in any of the methods that have been detailed. The cultivators must, in fact, feel that they can turn to the Department for further assistance which will be willingly given to them. With the spread of primary education it will be possible more easily to win their confidence, but success depends much more on the personality of the officers of the Department than on any system.

It must be remembered too, that one great essential is to find by careful local investigation the *actual* needs of the cultivators rather than recommended outside methods which may be improvements, but are not acceptable under the local conditions.

Another point which it seems desirable to emphasise is the necessity of being absolutely sure of the ground before attempting to introduce an improvement, and even in such cases it is inadvisable to try to improve practices in vogue without a carefully considered plan.

Finally, the Sub-Committee desires to urge that work should be concentrated on comparatively small areas at one time and energy not dissipated over a large stretch of country. Once a method is thoroughly established and recognised as an improvement over a small area, a knowledge of it will spread naturally and without effort over similar areas in the surrounding country.

The Sub-Committee feels that its report has reached a much greater length than was anticipated, but in matters of this sort, it feels it essential to go into considerable details, because details which at first sight seem unimportant, very often, in such matters as at present under consideration, have been the determining factor in the success or failure of the work undertaken.

THE CULTIVATION IN INDIA OF FIBRE PLANTS.

The report of Sub-Committee (E) was considered. Several members considered that the report is incomplete and referred to a number of important matters that are not included.

68. The Board decides that the report as submitted be referred by the President to each Provincial Director of Agriculture in order that for each province all information available on the subject be gathered, so that the report before publication should be made as complete as possible. The President will then amplify the report and refer it back to the members of Sub-Committee (E) for revision, and will arrange for its publication in pamphlet form.

THE SYLLABUS OF STUDIES IN THE PUSA AND IN PROVINCIAL COLLEGES.

The report of the Sub-Committee (G) was considered.

69. Mr. Molony stated that he was not aware that the question of the syllabus of Provincial Agricultural Colleges would be considered and that he had been unable to consult all the officers of his department on this most important question. He thought that it would be advisable to postpone the discussion until next year. This was not adopted.

70. Mr. Sly enquired whether advanced students could be taken at Pusa at once. The President replied in the affirmative.

71. Mr. Sly approved the recommendation of the majority of the Sub-Committee that practical training in the field during the first year should form part of the syllabus in Agriculture in Provincial Colleges. It is, in addition to the advantage gained by practical work from the start, the most useful method of weeding out

unsuitable students only in the course. Messrs. Leather, Howard, Gourlay, Sampson, Evans and Meggitt agreed with this view. Mr. Howlett said that the only difficulty appears to be in arranging the course so that no practical work should be undertaken which required for its proper performance any theoretical knowledge before such knowledge had been acquired. Mr. Burney said that he looked on Agriculture as a technical art based on several sciences. In similar cases elsewhere the best opinion holds that specialization should be postponed as far as possible until the full educational value of the sciences concerned has been realised. He regards the sciences of Chemistry, Botany, Zoology and the like as primarily educational and hence they should be taken before their practical application is attempted.

72. Mr. Lefroy suggested that the course of Zoology recommended by the Sub-Committee be omitted from the syllabus. It is, as defined, a pure science course, based on dissections, and of no direct value to agricultural students. Mr. Howlett supported Mr. Lefroy. Dr. Mann said that the students came up absolutely ignorant of even the rudiments of Zoology and scarcely know the difference between bone and muscle. He considered that the course suggested should be retained. Mr. Milne agreed with Dr. Mann. An elementary course is all that is required, but he considered it would be a disgrace to give the diploma in Agriculture proposed, to students entirely ignorant of Zoology.

Mr. Lenke desired to point out that the Entomology and Zoology courses recommended in the syllabus are incompatible with the views expressed in the note of dissent appended to the report. He looked on Zoology as a subject for general education. To substitute or even to introduce a considerable element of Entomology is to plunge straight into specialization.

73 The Board adopts the report of Sub-Committee (G) as follows, with the omission of the course in Zoology in the standard curriculum for Provincial Agricultural colleges :—

With regard to item (a) of the terms of reference, the Sub-Committee is of opinion that the class of instruction at Pusa which will be of the most advantage to the Provinces is a post-graduate course for students who have already obtained a degree at a Provincial Agricultural College. The Pusa advanced course might also be open with the special permission of the Director of Pusa, after consultation with the heads of the sections concerned, to students who are not graduates of a Provincial Agricultural College, but who, by reason of their education in science, are likely to derive real advantage from the advanced course.

The Sub-Committee is further of opinion that suitable courses should be provided at Pusa for the following :—

- (i) Students who will afterwards discharge the duties of Assistants to Provincial Experts in Agriculture, Agricultural Chemistry and, in particular, in Economic Botany, Mycology and Entomology
- (ii) Students sent for special purposes.

It recommends that curricula or schemes of study should be framed for each of the courses of training required in class (i) and should be submitted at the next Meeting of the Board of Agriculture. It does not consider it practicable to frame definite curricula immediately owing to lack of time, and because it is a matter which requires careful consideration in view of the fact that the Provincial staffs have insufficient experience as yet in the working of the Colleges.

The Sub-Committee is of opinion that the consideration of item (b) of the terms of reference should be deferred until the next Meeting of the Board of Agriculture.

With regard to item (c) of the terms of reference the Sub-Committee, having considered the general principles relating to Agricultural Education recommended by the Board of 1906 (Board's Proceedings, 1906 items 5 to 9), desires to make the following remarks :—

The Sub-Committee re-affirms item 5 of the Board's Proceedings of 1906.

The following changes in item 5-A are recommended :—

The word "might" in the first line to be changed to "should" and the word "assist" in the second line to be omitted.

The words in lines 5 to 7, from "which would fit them" to the end of the sentence to be altered to "which would fit them for managing their own or other private estates, for employment as Managers of Farms of

Wards Estate, and District Associations and for upper subordinate posts in Agricultural Departments." The words after "propose" in line 7 to the end of the sentence to be changed to "a course which should admit of a moderate amount either of expansion or reduction to meet local conditions."

In item 6 it is recommended that the words in lines 4 and 5 "*private students who may not have in view employment in Government service and who*" be altered to "*such students as.*"

Items 7 and 8 are re-affirmed.

The Sub-Committee recommends that the words in item 9 after "*course*" to the end of the sentence be changed to "*and that the only agricultural instruction in the first year should be practical training in the field.*"

Regarding the standard curriculum for Agricultural Colleges determined upon by the Board of 1906 (Board's Proceedings 1906, item 74), the Sub-Committee desires to re-affirm the rough time-table proposed at the head of the curriculum.

It re-affirms the Agricultural Syllabus.

It re-affirms the Syllabus in Physics and Chemistry, with the addition of the following to the note prefixed to the Syllabus:—

"NOTE.—It is to be understood that the student is not expected to possess a comprehensive knowledge of every item in the Syllabus. The object of the course is to enable the student (a) to understand what are the chief chemical and physical properties of matter, and (b) to obtain a knowledge of these properties as regards substances with which he is brought into direct contact in agricultural work. In the Organic Chemistry course "only a general knowledge of constitution is required."

It recommends the omission of the note on page 21.

With regard to the Botany Syllabus it recommends that the introductory note (page 22) be omitted, that after the heading *Botany* the words in small print be omitted and the words "*two alternative Syllabuses are put forward*" be added, the two schemes to be simply numbered 1 and 2.

It is recommended that the Syllabus in Entomology and Zoology be amended to read as follows:—

ENTOMOLOGY.

FIRST STAGE—CLASS WORK.

(1) The structure of a caterpillar, and of various types of winged insects, including only the following:—head, thorax, abdomen, segments, eyes, antennæ, mouthparts, legs, prolegs, wings, spiracles, ovipositor. These are to be shown in as many large types as possible and no other terms are to be used (pages 3-9)*.

(2) The stages in the life of a typical butterfly (*e.g.*, *Danaus plexippus*, the akh caterpillar) and of a grasshopper or bug. The life of each to be treated in as much detail as in Indian Insect Pests and every stage shown *alive* (pages 15-21).

(3) The distinction between insects with and without a metamorphosis, as shown in different types.

(4) The characters of the seven orders in the winged stage (pages 52-55) and the more prominent immature stages, caterpillar, maggot, grub. The meaning of the terms egg, larva, caterpillar, maggot, nymph, pupa, chrysalis, cocoon, unago (pages 55-57).

(5) The placing in its order of every insect captured and brought to the class by students or lecturer until each order is recognisable at once.

(6) The distinction from insects of allied forms of life, likely to be mistaken, *e.g.*, spiders, mites, ticks, centipedes, millipedes (pages 1 and 2).

(7) A short account in class of every insect found to be injurious on the farm or in the field, of which specimens (alive) are brought into class by students or the lecturer.

(8) Demonstration of the insects maintained alive by the lecturer in the laboratory.

* References to pages and chapters refer to "Indian Insect Pests."

(9) The food of insects, attention being drawn simply to the fact that insects fall mainly into the following classes :—Plant feeding, scavenging, predaceous, parasitic, insects on warm-blooded animals, household insects and aquatic insects. The recognition of biting and sucking mouthparts (pages 10-14, 6 and 7).

FIRST STAGE — PRACTICAL WORK.

Demonstration on the farm or in the field of any available insects ; the order they belong to ; how they feed, and on what ; what stage of life they are in and what they will become or what they have come from. Collection by the students of all available stages of commoner forms which are brought into class. Demonstration of all injurious insects, the student being encouraged to find any stage of the insects previously described by the lecturer in class.

Whenever possible, an hour's field work is followed by an hour's demonstration, in class, of the insects collected and the specimens of damaged plants brought in. Such combined field work and demonstration would alternate with formal lectures or take the whole time during the rainy season or when crops were ripening.

SECOND STAGE — CLASS WORK.

1. A general account of the features of insect life as given in pages 22 and 23 of *Indian Insect Pests*.

2. An account of the Chapters V-VII of *Indian Insect Pests*.

3. More detailed accounts of injurious insects occurring on the Farm or reported from the Province. *when the stages of each pest can be shown*, with an account of such remedies or preventives as can be used.

4. Useful insects, including bees, lac, silk (Leaflet).

5. Insects destructive to grain and stored produce (Chapter XIX and Leaflet).

6. Insects injurious to cattle ; the part played by insects in disseminating disease (Chapter XX).

7. Beneficial insects (Chapter XXI).

8. Form and colour in insects (Chapter III)

The lecturer should revise the notes taken in lecture and those taken of the pests seen in the field and shown in class. Reports should be written by every student of cases of pests seen in the field and these should be corrected by the lecturer, who should draw attention to the important points. Demonstrations of the methods of packing specimens alive for sending through the post.

SECOND STAGE — PRACTICAL WORK.

Demonstration on the farm or in the field of all injurious and common insects, but paying special attention to :—

1. Predaceous insects, insectivorous birds, &c.

2. Parasites.

3. Preventive measures.

4. Remedial measures.

5. Distinguishing important from unimportant insects on a crop, and ascertaining exactly what is the real cause of damage.

6. The meaning of the form, colour and attitudes of insects as seen in the field.

When any remedial measures are adopted in the farm, the students should be present and there should be demonstrations of spraying, with lead arsenate, crude oil emulsion, kerosene emulsion, the last being made on the spot. The use of crude oil emulsion on cattle to destroy ticks, &c., should also be shown.

As before, whenever a pest occurs on the farm, the teacher should have combined field-work and demonstration, following a lecture on that pest.

THIRD STAGE — CLASS WORK.

A complete account of the crop pests of the Province treated crop by crop, as in "*Indian Insect Pests*." For this, the information given in leaflets should be used.

where available, but no more detail should be given than is in Indian Insect Pests. As many stages as possible must be shown. Latin names are not to be used for plants or insects. The heads of each lecture are:—

1. The pest, how recognised in the field—Vernacular names.
2. Life history.
3. Habits and destructiveness.
4. Distribution in the Province.
5. Seasons at which it is found.
6. Parasites and enemies.
7. Treatment.

With these lectures alternate the field-work and demonstrations, the lecturer also revises the student's notes of each pest, seeing that he completes them from previous notes and that he has a fairly complete account.

A revision of the more important pests, not crop by crop, but order by order, so that the student may have an idea of the relative economic importance of each order and know what pests are closely allied.

THIRD STAGE — PRACTICAL WORK.

Demonstration of every injurious insect found on the farm or in the field, and of its enemies and checks. The important points to be noted in reports are drawn attention to and the students taught to see and note the facts they require for the reports they draw up in class afterwards.

ZOOLOGY.

The course in Zoology is intended to be introductory to the study of Veterinary Science and Entomology. Students should make themselves practically acquainted with the structure of the following types:—

- (a) A small mammal.
- (b) A frog.
- (c) An invertebrate.

The Sub-Committee re-affirms the Syllabus in Veterinary Science.

In the Syllabus of Agricultural Engineering it recommends the addition of the following words in brackets under the section "*simple dynamics and machines*."

"(The training should be practical as far as possible.)"

The Sub-Committee further recommends that the Syllabus as now revised be printed separately for circulation to officers concerned.

NOTE OF DISSENT.

The following note of dissent, by certain Members, to the recommendations of the Sub-Committee under item (c) is added to the report.

The undersigned consider that the students who now attend and for some time to come will attend the Provincial Agricultural College are, and will be, deficient in respect of a good general education.

We consider therefore that it should be clearly recognised that the courses given at the Colleges fall into two definite groups:—

- (1) Subjects taught for their educational value.
- (2) Special subjects directly connected with Agriculture.

We regard agriculture to be an art based on the several sciences and not a science of itself and therefore propose as subjects under the first heading the sciences on which the art of agriculture is founded; but these subjects should be taught in such a way that the main object of a sound education may be achieved

These subjects are Chemistry, Physics, Botany, Zoology and Mathematics. We are of opinion that no sound teaching can be given in the second class of subjects until at least a sound basis is laid in the first.

The first year's course should, therefore, consist only of subjects falling into the first class, that is to say, the exact sciences. This will lay the necessary foundation for the second class of subjects.

It will, however, be impossible to do more in the first year than lay the foundation of a sound education and it will be necessary to continue some of these subjects in the second and possibly the third year. In the second year subjects falling into the second class may be commenced.

Taking into consideration the many disadvantages under which the Indian student approaches the study of science in a foreign language, it seems to us unlikely that it will be possible to do more in the three years than carry the educational subjects retained to the point at which specialization may safely begin and as such specialization is only required in the few who remain in the Department, these would, of necessity, have to undergo a post-graduate training in that special subject.

G. CLARKE.

H. M. LEAKE.

J. H. BARNES.

We thoroughly endorse this view having regard particularly to the fact that the necessary breadth will have been given to the student's education by his having mastered thoroughly one language—English—before coming to the College.

A. C. DOBBS.

F. M. HOWLETT.

SCHEME OF INSTRUCTION FOR INDIAN AGRICULTURAL STUDENTS IN ENGLAND.

74 The President stated that as the Board has already been informed that higher instruction in the sciences pertaining to agriculture will immediately be provided at Pusa, he wished to omit this subject from the Board's Programme. This was agreed to, and the meeting terminated.

APPENDIX A.

PROGRAMME OF THE 4TH MEETING OF THE BOARD OF AGRICULTURE.

SUBJECT I.—*The confirmation of the Proceedings of the last meeting.*

SUBJECT II.—*The programme of work of the Imperial Department of Agriculture.*

A consideration of the programmes of—

- (1) The Director, Agricultural Research Institute, Pusa ;
- (2) The Imperial Agricultural Chemist ;
- (3) The Imperial Mycologist ;
- (4) The Imperial Entomologist ;
- (5) The Second Imperial Entomologist ;
- (6) The Imperial Economic Botanist ;
- (7) The Imperial Agriculturist ;
- (8) The Imperial Bacteriologist.

2. Provincial Directors should examine them to see whether they meet the requirements of their own Provinces: Imperial Experts should examine them to see whether the programmes of branches, other than their own, meet their requirements.

SUBJECT III.—*The programmes of work of the Provincial Departments of Agriculture.*

A consideration of the programmes submitted by—

- | | |
|----------------------------|--------------------------------|
| (a) Bengal ; | (f) The Central Provinces ; |
| (b) The United Provinces ; | (g) Eastern Bengal and Assam ; |
| (c) The Punjab ; | (h) Burma ; |
| (d) Bombay ; | (i) Mysore State ; |
| (e) Madras ; | (j) Baroda State ; |
| | (k) Kashmere State. |

2. The Imperial Experts should consider whether the programmes meet their requirements and whether they can suggest improvements. The Provincial Directors should consider whether the programmes of other Provinces can be improved so as to meet any special requirement of their Provinces or to co-ordinate the work.

SUBJECT IV.—*The lines on which the Entomological and Mycological work in the Provinces (for which no European Experts have been sanctioned) should henceforth be conducted; the expansion of the different sections of the Imperial and Provincial Departments of Agriculture and the adequate rates of pay which should be given in order to attract and retain the best men in the Subordinate Agricultural Service.*

A consideration of the note prepared by the Inspector-General of Agriculture (See Appendix D).

SUBJECT V.—*The best methods of getting into touch with cultivators and the instances in which and the means by which experimental works of proved value have already been successfully brought home to the cultivators.*

A discussion as to the best lines for future work.

SUBJECT VI.—*A study regarding the extension of cultivation in India of fibre plants other than cotton and jute, such as hemps, agaves, etc., and the effect of such extension of cultivation on the material prosperity of the country.*

A discussion as to best lines for future experimental work.

SUBJECT VII.—*The scheme regarding the course of instruction which Indian students deputed to England to specialize in Mycology, Botany, Entomology or Chemistry should undergo.*

A consideration of the notes by Mr. C. A. Barber and the Expert Officers of the Imperial Department of Agriculture.

SUBJECT VIII.—*Measures to improve the breed of Poultry in India.*

A consideration of a letter received by the Government of India, Revenue and Agriculture Department, from Mr. H. E. Abbott, Editor of the Indian Fowl Fanciers', Gardeners' and Farmers' Gazette.

SUBJECT IX.—*The future constitution of the Board of Agriculture in India.*

A consideration of the suggestions contained in the Government of India, Revenue and Agriculture Department, Circular letter No. 23-28-24, dated the 15th August 1907, to all Local Governments and Administrations regarding the constitution of the Board. The matter will be referred to a committee before being discussed by the Board.

SUBJECT X.—*The Improvement of the form of the Report of the Proceedings of the Board of Agriculture.*

A consideration of the suggestions contained in paragraph 3 of the Government of India, Department of Revenue and Agriculture, letter No. 208-28-38, dated the 1st February 1908.

J. MOLLISON,
*Inspector General of Agriculture in India and
President, Board of Agriculture in India.*

APPENDIX B.

PROGRAMME OF THE IMPERIAL DEPARTMENT OF AGRICULTURE FOR 1908-09.

Programme of the Agricultural Research Institute, Pusa.

The scientific work of the Institute for the coming year is indicated in the programmes submitted under the different sections.

Among the investigations mentioned, attention may be drawn to the following more important examples :—

- (a) *Rotation Experiments*, in the programme of the Imperial Agriculturist, in which the fertilizing value of leguminous crops and fallows in rotation with cereals and other crops will be investigated. The action of the organisms of the leguminous crops and the bacteria in the soil will be simultaneously dealt with by the Imperial Bacteriologist, and the Imperial Agricultural Chemist will take up the chemical aspect.
- (b) *Grass Experiments*, by the Imperial Agriculturist and Imperial Economic Botanist, to ascertain the effects of manurial and other treatment on the yield and on the varieties of grasses which were initiated during the past year, will be continued, and matters connected with the chemical section will be dealt with by the Imperial Agricultural Chemist.
- (c) The more precise determination of availability of plant food in Indian soils is being continued by the Imperial Agricultural Chemist.
- (d) Investigations on Indian wheat and experiments on Indian fruits will be continued by the Imperial Economic Botanist.
- (e) The investigations into the biting flies of India, commenced by the Imperial Entomologist, will be specially taken up and continued by the Second Imperial Entomologist, Mr. Howlett.

The above-mentioned investigations indicate only the more important scientific work of the Institute during the coming year, including problems of a far-reaching character of great importance to Indian Agriculture. Besides this, the different sections will perform the work connected with minor investigations. The Entomological and Mycological Sections will continue their work on pests and diseases.

The European Scientific Staff of the Institute will for the first time be complete and will consist as follows :—

- (1) The Imperial Agriculturist, with one Supernumerary Assistant.
- (2) The Imperial Agricultural Chemist, with one Supernumerary Assistant.
- (3) The Imperial Economic Botanist, with one Supernumerary Assistant.
- (4) The Imperial Entomologist, with one Supernumerary Assistant.
- (5) The Second Imperial Entomologist.
- (6) The Imperial Mycologist, with one Supernumerary Assistant.
- (7) The Imperial Bacteriologist.

The Phipps Laboratories will be ready for occupation during the year and the apparatus and records will be transferred to the new building.

Regarding the question of the admission of students, the intention has been that distinguished students of the Provincial Agricultural Colleges should be sent to Pusa for a two years' course in specialising, but as some time must elapse before the arrangement can be given effect to, it is proposed that students should be selected by the Provincial Governments and given a general agricultural education at Pusa.

The publication work will be carried on as before and the stocking and indexing of the Library will continue. A Library Catalogue is in the Press and will be issued very shortly.

B. COVENTRY,

*Director, Agricultural Research Institute, and
Principal of the Agricultural College, Pusa.*

I.—AGRICULTURAL CHEMISTRY.

Available plant food in soils.—This subject has been referred to in previous programmes. The work during the past year has been on the lines already indicated, but in addition to work at Pusa, field experiments on the value of superphosphate are being conducted at a number of centres in Behar, that is, the laboratory results are being tested in the field. Whilst this work is yielding useful information, it must be fully recognised how empirical are our methods, and the laboratory work at Pusa is now being directed to a more thorough examination of the precise state of the compounds in the soil, the phosphates forming the first main objective. The more exact relationship of the carbonic acid gas in the soil to plant foods forms another part of the same subject.

Water in soils.—This subject divides itself under two heads, namely, drainage and evaporation. The four gauges at Pusa are providing interesting data regarding the former, which are supplemented by those at Cawnpore, the Director of Agriculture, United Provinces, being kind enough to allow me to co-operate with his department in this connection. In addition to the gross amount of water passing away, data are being collected regarding the rate of percolation and the nature and amount of dissolved substances which are carried with the drainage water.

The records of evaporation which are being maintained have so far led to two important conclusions, the one being that during dry weather water rises in the soil from a limited depth only, the other that the rate of loss depends (among other things) on the amount of water present. There is some hope, too, that the true relation between physical properties of a soil and its power to retain water may be rendered clearer than it is at the present day. An account of the first year's work is in the press.

A knowledge of the amount of water in a soil is, however, only one factor of a larger subject, for it is equally important to know how much water crops require. Tentative experiments are in progress on this part of the subject. The data which have been published in Europe and America are not only divergent among themselves, but would not, without verification, be applicable to Indian conditions. It is obvious that a more exact knowledge of the movements of water in soils will, at the same time, yield information as to the movements of dissolved substances, whether these are valuable plant foods or deleterious salts; at present this subject is chiefly characterised by its nebulous state.

The Chemical investigations connected with the permanent field experiments at Pusa.

Cyanogenetic glucosides.—It was explained in my last programme that the work on this subject is restricted at Pusa to the ascertainment of the conditions under which these compounds are formed in large quantity in the plant, and I cannot at present say much more than that the work is in progress. Some positive results were obtained last year with jowar (*Andropogon sorghum*), but it would be premature to publish them at present.

J. WALTER LEATHER, PH. D.,
Imperial Agricultural Chemist.

II.—ECONOMIC BOTANY.

Plant breeding and Plant improvement.—During 1908 the following crops will be studied — Wheat, tobacco, cotton and barley as well as important *abi* and *kharif* crops grown in Behar. The determination of the varieties of Indian wheat, tobacco and barley will be continued.

Fibre plants.—The collection and investigation of fibre yielding plants will be continued.

Fruit experiments.—The permanent experiments on the culture of Indian fruits will be continued on the lines laid down in the first report.

Minor investigations.—The study of Cassava as a famine food-stuff (with Dr Leather). The economic importance of the male plant in Ganja cultivation.

Publications.—The monograph on Indian wheat will be completed.

R. J. D. GRAHAM, M.A.,
Acting Imperial Economic Botanist.

III.—MYCOLOGY.

1. *Training*.—The training of probationers for posts of Mycological Assistants in the Provinces will be continued if any are sent up. Three have been accommodated during the past year and their places are now vacant.

2. *Research and experimental work*.—The amount of Pathological work of pressing importance which has arisen during the past year has led to the temporary abandonment of the work on *soil fungi*, referred to in my last programme. The following are the chief diseases at present under investigation :—

- (a) *Diseases of indigo*.—The introduction of the Java-Natal variety of this plant has led to severe outbreaks of disease. Its successful cultivation at the present moment centres on the checking of these diseases. They have not, however, been previously studied, and much investigational work is needed before even their causes can be determined.
- (b) *Wilt diseases of cotton, gram and pigeon pea (rahar)*.—The prolonged investigation of these diseases will be continued, and others taken up if occasion arises. Sesamum wilt will be investigated.
- (c) *Diseases of citrus fruits*.—A number of these have been recently reported and are under study. The results will probably be ready for publication during the year.
- (d) *Palm diseases*.—The biologic study of the parasite of bud rot is practically completed. Assistance will continue to be given in the operations to check this disease in Godavan.
- (e) *Sugarcane diseases*.—Field experiments with red rot and smut will be continued.
- (f) The identification and study of other crop diseases will continue as usual. A commencement has been made in preparing a text-book of Indian crop diseases, and it is hoped to complete this.

3. *Systematic work*.—The identification and recording of the species of *fungi* collected in India will be continued with assistance from abroad. Three of the main groups have been finished up to date from the Pusa collections. The three largest, however, remain.

E. J. BUTLER, M.B.,
Imperial Mycologist.

IV.—ENTOMOLOGY.

The work of the past year in studying and advising on insects injurious to crops will be continued. Special attention will be paid to insects injurious to indigo, to the problem of controlling Surface Grasshoppers and to pests of rice. Assistance will be given in directing the work of Provincial Assistants and in coping with any outbreaks of pests that may occur; this may form a large part of the work of the year, but the extent to which Provincial Departments of Agriculture will require assistance cannot be estimated until after the meeting of the Board.

No new investigations of an extensive nature can now be proposed. The enquiry into insecticides non-poisonous to cattle will be continued. The experimental cultivation of lac and of eri silk will be continued, and it is proposed to very tentatively take up other wild silks. The transfer of the economic collections to the main laboratory and the arrangement of records, collections, etc., for teaching will occupy some time. Should the teaching of advanced Entomology be taken up, the preparation of the syllabus will also require to be done. Simple leaflets to explain coloured plates illustrating common injurious insects will be prepared primarily for use in the Central Provinces, but this work will be extended to other Provinces, if necessary. To what extent this work will develop cannot now be foreseen, and, if necessary, other work will be dropped to give time for this.

The study of insect-eating birds will be continued by the Supernumerary Entomologist and further inquiry will be made into fumigation methods for treating grain and plants and into methods of checking white ants. A month's course of elementary Entomology will be given at Nagpur by the First Assistant.

No definite arrangements can now be made for further work pending the result of the discussion by the Board of the lines on which Entomological work is to be developed.

H. MAXWELL-LEFROY, M.A.,
Imperial Entomologist.

PART II.

The investigation of the biting flies of India, begun by the Imperial Entomologist, will be continued and extended, the distribution and breeding habits of the various species being especially studied, as being most likely to afford information of value in connection with the spread of disease.

Dipterous pests of crops will be studied as opportunity occurs. The sorting and arrangement of the collection of Diptera will be undertaken, and the species identified, wherever possible, while the care and maintenance of the large general collection will be taken over from the Imperial Entomologist and continued on the same lines as hitherto. The preparation of the text and illustrations of the book on Indian Insects will be continued in collaboration with the Imperial Entomologist.

F. M. HOWLETT, B.A.,
Second Imperial Entomologist.

V.—AGRICULTURAL BACTERIOLOGY.

Some of the following problems will be attacked as opportunity offers and time permits:—

- I.—The chief bacteria characteristic of Indian soils, particularly those taking part in—
 - (a) The fixation of Nitrogen.
 - (b) The rotting of organic material.
 - (c) Nitrification.
- II.—The characteristic organisms growing in association with leguminous crops in India, with particular regard to the inoculation of the soils growing them.
- III.—The bacteria taking part in the rotting of stored organic material under Indian conditions and the bearing of the knowledge gained on the conservation of cattle-manure in India.
- IV.—The fermentation processes accompanying the manufacture of Silage in India.
- V.—The fermentation processes taking place during the manufacture of Tobacco.
- VI.—The fermentation processes taking place during the manufacture of Indigo.
- VII.—Any bacterial diseases of important Indian crops.

C. BERGTHEIL,
Imperial Bacteriologist.

VI.—AGRICULTURE.

- (1) *Permanent manurial experiments.*—These are described in detail in series I below.
- (2) *Permanent Rotation experiments.*—These are described in detail in series II below.
- (3) *Permanent Wheat and Maize Manurial experiments.*—These are described in detail in series III below.
- (4) *Permanent Pasture Experiments.*—These will be continued according to the revised scheme appended. These experiments are not considered of the first order.

(5) *Sugarcane*.—Work on sugarcane will include (1) methods of planting, (2) methods of manuring, (3) selection by sports or otherwise. This work is not considered of the first order.

(6) *Flax and other Fibre Crops*.—The possibility of establishing a flax industry in this country will, in collaboration with Mr. Pinlow, be further investigated. Experiments on the cultivation and preparation of flax will be conducted on a larger scale than hitherto. The flax will be grown in rotation with Indigo but these crops will not occupy the same land oftener than once in four years. The work will include plant selection in flax and in Indigo. Sann-hemp (*Crotalaria juncet*), *Sida rhombifolia*, *Hibiscus cannabinus*, *Hibiscus panduriformis* and *Malachra capitata* will be tested on a field scale. This work is not considered of the first order.

(7) *Tobacco*.—A fairly large area of selected indigenous and exotic varieties will be grown and experimental work in curing will be done in the curinghouse.

(8) *Varieties*.—Varieties tested will include those of wheat, rice, maize, opium and castor. Plant to plant selection will be carried out wherever possible.

(9) *Thrashing Trials*.—These will be continued on the same lines as last year with special reference to wheat.

(10) *Breeding*.—The breeding of bulls for the province of Bengal will be continued. A Dumbha ram has been purchased and he will be crossed with selected ewes. Poultry breeding will be carried on with selected imported and indigenous breeds. In connection with the cross-breeding of sheep and poultry Mendel's Laws will come under study.

(9) The general improvement of the estate will be continued.

Note on the permanent experiments at Pusa.

The problem of agriculture is to secure from the soil the maximum production possible under the existing conditions and with the resources at the command of the cultivator. Next to climate the most important factor in production is the degree of fertility of the soil. Soil fertility is conditioned by circumstances which are still far from being properly understood. While in a large measure a quality inherent in the soil, it may be profoundly modified by agricultural practice with respect to cultivation, manuring and rotation of crops. The proposed permanent experiment detailed below have been arranged with a view to study the conditions which determine soil fertility in a subtropical climate, and in particular the manner in which soil fertility is affected by the application of the important manures, including green manure, by rotation of crops (with special reference to the part played by legumes in a rotation), by cultivation and by fallows.

SERIES I.

Permanent Manurial Experiments.

The object of this series is to determine the specific effect on soil fertility of the more important organic and chemical manures applied alone and in various combinations to a two years' four course rotation.

<i>Kharif.</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	Manures applied per acre
1 Maize	Rahar	Maize	Oats	No manure.
2 Maize	Rahar	Maize	Oats	Farm-yard Manure to supply 10 lbs. Nitrogen
3 Maize	Rahar	Maize	Oats	Farm-yard Manure to supply 20 lbs. Nitrogen
4 Maize	Rahar	Maize	Oats	Farm-yard Manure to supply 30 lbs. Nitrogen
5 Maize	Rahar	Maize	Oats	Rape cake to supply 20 lbs. Nitrogen
6 Maize	Rahar	Maize	Oats	Sulphate of Ammonia to supply 20 lbs. Nitrogen
7 Maize	Rahar	Maize	Oats	Sulphate of Potash to supply Potash as in Farm-yard Manure No. 3
8 Maize	Rahar	Maize	Oats	Superphosphate to supply Phosphoric acid as in Farm-yard Manure No. 3.
9 Maize	Rahar	Maize	Oats	Sulphate of Potash to supply Potash as in Farm-yard Manure No. 3.
				Superphosphate to supply Phosphoric acid as in Farm-yard Manure No. 3.
				Sulphate of Ammonia to supply Nitrogen as in Farm-yard Manure No. 3.
10 Maize	Rahar	Maize	Oats	Sulphate of Potash to supply Potash as in Farm-yard Manure No. 3.
				Superphosphate to supply Phosphoric acid as in Farm-yard Manure No. 3.

Plots to be $\frac{1}{4}$ acre duplicated and all the crops of each rotation to be grown in the same year. Manures to go on every year on the maize.

SERIES II.

Permanent Rotation Experiments.

This series is designed to determine how far soil fertility is affected by growing in a rotation leguminous crops (1) removed from the land, (2) returned to the land in the shape of green manures. It is complementary to series I, inasmuch as the results obtained will give an indication of how far legumes can replace manures in a rotation.

Kharif	Rabi	Kharif	Rabi	Remarks
1 Maize	Barley	Maize	Oats	No manure
2 Maize	Barley	San Hemp	Oats	Green manure on cereal rotation
3 Maize	Rahar	Maize	Oats	Residual value of deep rooted pulse
4 Maize	Rahar	Maize	Oats & Peas	Residual values of two legumes one deep and one shallow rooted
5 Maize	Rahar	San Hemp	Oats	Residual value of a pulse crop plus a green manure.

Plots to be $\frac{1}{2}$ acre duplicated and all the crops of each rotation to be grown in the same year.

SERIES III.

Permanent wheat and maize Manurial Experiments.

This series has been prepared on the plan of the Rothamsted permanent manurial wheat plots but has been modified to suit Indian conditions. It was necessary to introduce maize as an alternate crop with wheat (1) because the land on which the plots will be grown normally carries two crops a year, and (2) because of the difficulty of keeping a bare fallow clean during the monsoon season.

Permanent wheat and maize Manurial Series.

No	Kharif	Rabi	Manure applied per acre
1	Maize	Wheat	No Manure.
2	Maize	Wheat	Farm-yard Manure=20 lbs Nitrogen
3	Maize	Wheat	Rape cake=20 lbs Nitrogen.
4	Maize	Wheat	Sulphate of Ammonia=20 lbs Nitrogen
5	Maize	Wheat	Sulphate of Potash to supply potash as in Farm-yard Manure.
6	Maize	Wheat	Superphosphate to supply P_2O_5 =that in Farm-yard Manure.
7	Maize	Wheat	Sulphate of potash to supply potash } as in Farm-yard Manure. Superphosphate to supply P_2O_5 }
8	Maize	Wheat	Sulphate of Ammonia to supply Nitrogen } as in Farm-yard Manure. Sulphate of Potash to supply Potash } Superphosphate to supply P_2O_5 }

Plots to be $\frac{1}{2}$ acre duplicated and all the crops of each rotation to be grown in the same year. The question of fallows will not be taken up this year.

*Permanent Pasture Experiments.**Manurial Scheme for Pasture Experiments.*

No	Details.	Remarks.
1	No manure	To be applied once, thereafter at the end of 3 years or other date to be subsequently fixed to be followed by 10 tons farm-yard manure repeated every fifth year.
2	Superphosphate=150 lbs. Phosphoric acid per acre.	
3	Basic slag=150 lbs. Phosphoric acid per acre	
4	Superphosphate=100 lbs. Phosphoric acid per acre	
5	Superphosphate=100 lbs. Phosphoric acid per acre	
6	Sulphate of Potash=50 lbs. Potash per acre	To be applied every fifth year.
7	Rape Cake=100 lbs. Nitrogen per acre.	
	Castor Cake=100 lbs. Nitrogen per acre.	

Manurial Scheme for Pasture Experiments—contd.

No	Details	REMARKS
8.	Ammonium Sulphate=20 lbs Nitrogen per acre	To be applied every year.
9.	Nitrate of Soda=20 lbs. Nitrogen per acre	
10.	Superphosphate=25 lbs Phosphoric acid per acre	
11.	Superphosphate=25 lbs. Phosphoric acid per acre	
	Sulphate of Potash=20 lbs. of Potash per acre	
12.	Superphosphate=25 lbs. of Phosphoric acid per acre	
	Ammonium Sulphate=20 lbs. of Nitrogen per acre	
	Superphosphate=25 lbs. of Phosphoric acid per acre	
13.	Ammonium Sulphate=20 lbs Nitrogen per acre	
	Sulphate of Potash=20 lbs Potash per acre	
14.	Farm-yard Manure=3 tons per acre	

The extent of even land available in the pasture land at Pusa is limited and the proposed experimental plots are, therefore, smaller than is desirable. The area in one block will be divided into 14 plots each of one-half acre. One-fourth of each plot will be fenced off and cut annually as hay, the remaining three-fourths will be grazed by cattle and simply kept under observation.

A detailed botanical examination of the character of the herbage of each plot will be undertaken.

E. SHEARER, M. A.,
Imperial Agriculturist.

APPENDIX C.

PROGRAMMES OF PROVINCIAL AND NATIVE STATES DEPARTMENTS
OF AGRICULTURE FOR 1908-09.

BENGAL.

1. There are at present five Agricultural Stations in this Province, viz., Burdwan, Bankipore, Dumraon (Shahabad), Sabour (Bhagalpur), and Cuttack.

Particulars regarding their physical and climatic conditions are given in the statement below :—

Serial No.	Name of station.	SITUATION.		Tract represented	Area in acres.	Types of soil	Date when established	Height above sea-level	Average rainfall in inches.	TEMPERATURE	
		North Latitude.	East Longitude.							Maximum	Minimum.
								Feet			
1	Burdwan	23° 70'	88° 00'		31		1887	90	57.51	80°	70°
2	Dumraon (Shahabad)	25° 30'	84° 00'		30		1895	239	11.13	88°	68°
3	Bankipore	25° 37'	85° 11'		210		1908	183	11.51	88°	69°
4	Sabour (Bhagalpur)	25° 12'	87° 1'		324		1900	100	40.35	97°	68°
5	Cuttack	20° 20'	85° 51'		60		1901	80	60.35	91°	73°

In addition to the above, an area of about 210 acres has been acquired at Chinsurah in the district of Hooghly for an Agricultural Station which will be representative of the Deltaic tracts of this Province and enquiries are being made with a view to obtaining suitable sites for stations which will be representative of the laterite tracts of the Province and Chota Nagpur. The following farms are also maintained :—

- (a) The Purnea and Berhampur Jute Seed Farms.
- (b) The Chakradharpur Cotton Farm.
- (c) The Chaibassa Tasar Farm.

II. The programme of work for 1908-09 in the stations is as follows :—

(1) *Burdwan*.—The experiments now being carried on will be continued, viz.:—

Jute experiments :—

1. Manure.
2. Cutting at different stages.
3. Variety.
4. Spacing.
5. Drill *versus* Broadcast sowing.
6. Rotation experiment with paddy.
7. Rotation experiment with potatoes.

Paddy Experiments :—

A. Manure.

1. First series—Quantitative.
2. Second series—Qualitative.
3. Third series—Green manuring.

B. Variety.

C. Cultivation.

1. Thick and thin sowing (broadcast).
2. Spacing in transplanting.
3. Number of seedlings per hole in transplanting.

Potatoes :—

1. Manure experiments.
2. Variety experiment.

Selected varieties of Sugarcane, Jute and Paddy will be grown for seed distribution. Cassava will be tried.

(2) *Bankipore*.—The laying out will be completed and the farm will be worked to get uniformity of conditions before commencing experiments. Sugarcane, paddy, gram, *juar* and vegetables will be grown for seed distribution.

(3) *Dumraon* (Shahabad).—The sugarcane and mustard experiments will be continued, *viz* :—

Sugarcane :—

1. Manure experiment.
2. Variety experiment.
3. Planting experiment.
4. Rotation experiment.

Mustard :—1. Variety experiment. Selected varieties of Sugarcane, mustard and *arhar* will be grown for seed distribution.

(4) *Sabour*. (Bhagalpur).—The College buildings will be pushed on. Laying out of the farm will be continued. Maize, *arhar* and *juar* will be grown for seed distribution.

(5) *Cuttack*.—The experiments now being carried on will be continued, *viz* :—

Jute experiments :—

1. Manurial.
2. Cutting at different stages.
3. Variety.
4. Rotation with Aman paddy.
5. Rotation with Potatoes.

Paddy experiments :—

1. Manurial.
2. Varietal.
3. Methods of cultivation.
 - (a) Number of seedlings per hole in transplantation—1, 2, 4 and 8.
 - (b) Quantity of seed per acre in broadcasting—25, 30 and 40 seers (medium sized grain) per acre.
 - (c) Different ploughs—Cuttack, Burdwan, Sibpur, Weston and Hindustan.
4. Irrigation.
 - (a) General.
 - (b) Application of different quantities of water (3" and 6") every 15 days.

Potatoes :—

1. Manure.
2. Variety.

Groundnuts :—

1. Manure.
2. Variety.
3. Rotation experiment.

Sugarcane :—Variety.

Turmeric.

Selected varieties of jute, paddy, sugarcane, groundnut, turmeric and papayas will be grown for seed distribution.

Chinsurah.—The laying out of the farm will be commenced.

Purnea and Berhampore Jute Seed Farms.—These two seed farms will be continued.

Chakradharpur Cotton Farm.—Plant to plant selection of seed of the Buri variety of cotton for distribution purposes will be continued. A manure experiment will be commenced.

Chaubassa Tasar Silk Farm.—Distribution of one year acclimatised cocoons for seed purposes will be continued.

III.—GENERAL.

Well-boring experiments will be undertaken. Cattle breeding at Sripur will be continued. Proposals for the improvement of sericulture have been submitted and it is hoped that work under this head will be undertaken.

UNITED PROVINCES OF AGRA AND OUDH.

I.—Section under the Deputy Director of Agriculture, including the agricultural stations at Cawnpore, Orai and Aligarh.

Cawnpore.—Only changes in detail have been made in the programme presented at last year's meeting of the Board. The investigations deal mainly with fundamental problems such as the effects of the continuous growth of crops on the same land with and without manure, the quantity and composition of drainage water, some of the chief existing rotations, the quantity of water required for various crops, and the loss of water in transit to the field. The remaining work is mainly selection applied to maize, poppy and cotton. The new investigations taken up include the trial of cotton-refuse as manure, methods of preserving potatoes and fruits, and the renewal of the seed-stock of potatoes in the hills.

At the Juhi outstation for the reclamation of non-alkaline barren land, practically the only experimental work in progress is the endeavour to reduce the cost of tree-planting by the use of an auger for drilling holes through the barren layer.

Orai.—The main objects of this farm are to study the question of tillage in Bundelkhand, both generally and in relation to the growth of *kans*, to make some use of the inferior soils, and to attempt to increase the diversification of crops.

Aligarh.—This station is intended mainly for the study of cotton. Indigenous and acclimatized varieties are grown, and it is the chief centre for the distribution of the latter kind among cultivators.

No new work has been undertaken at the alkali sub-station at Gursikran.

II.—Section under the Assistant Director of Agriculture, including the agricultural station at Partabgarh and the investigations in sugar-manufacture.

The Assistant Director is on special duty for the greater part of the year in connection with the organisation of sugar-factories following his methods of manufacture. The field work at Partabgarh is preliminary; areas that appear suitable for experiments have been cropped uniformly and the yield is being tested by harvesting in small compartments. Meanwhile, only a few preliminary experiments with sugar-cane are in progress. The station is the centre of seed distribution on credit. A small alkali outstation has been formed for trial of gypsum, and another for the prevention of ravining.

III.—Section under the Economic Botanist.

The Economic Botanist is engaged mainly in organising the biological side of the Agricultural College. His experiments with cotton have advanced and a preliminary note of the scientific results is in course of publication. Information concerning the agaves of the province is being collected.

IV.—Section under the Agricultural Chemist.

The Agricultural Chemist is engaged mainly in organising the chemical side of the Agricultural College. He is taking up preliminary experiments with a view to the study of the losses in sugar manufacture recommended by the Board at its last meeting.

V.—Well-section, under the Director.

This section is engaged in placing out borers where they are wanted; in investigating the form of percolation-wells in sand, and the improvement in rock-wells; and in classifying the various areas of the province according to the nature of their resources and their needs.

PUNJAB.

PROGRAMME OF WORK FOR THE CURRENT YEAR OF THE DEPUTY DIRECTOR OF AGRICULTURE, PUNJAB.

1. Investigation of the Reh question in collaboration with the Agricultural Chemist.

2. The introduction of harvesting machinery to the notice of cultivators.
3. Demonstrations of improved sugar-making methods.
4. Distribution of American cotton in the Jhelum and Chenab Colonies.
5. District trials of cottons (Egyptian cotton in South-West Punjab, American and Egyptian at Hissar).
6. Seed distribution generally.

PROPOSED NEW WORK.

7. Establishment of a second Experimental Farm.

Preliminary investigations with reference to:—

- (i) Diseases of gram in collaboration with the Economic Botanist, Punjab.
- (ii) The question of fodder scarcity particularly in the south and east of the Province, and the possibility of increasing the yield of crops by manures or otherwise on irrigated tracts in, and adjoining, famine areas.
- (iii) Improvement of tillage in backward districts.
- (iv) Study of crop rotations in special districts.

PROGRAMME OF WORK OF THE PRINCIPAL, PUNJAB AGRICULTURAL COLLEGE, FOR 1908-09.

1. Little progress having been made with the equipment of the Lyallpur College and the framing of the curriculum and prospectus, the bulk of this work will fall in the present year.

2. The laying out and equipment of the Agricultural Station for experimental seed-growing and recreational purposes will claim a good deal of attention.

3. At the Lyallpur Agricultural Station constant observations will be made on, and attention given to, the experiments already in progress. These have been somewhat modified during the last year.

- (a) The most noticeable advance has been the laying out, for comparative experiments, of the area tested last year. This area having been found, as was to be expected, uneven in quality, 12 acres were laid out, in the light of the information obtained by the testing, in plots which are expected to give consistent results. The experiments on this area include the comparison of:—

- (1) Varieties—principally of wheat and cotton.
- (2) "Cinereal" manuring.
- (3) Nitrogenous manuring—including the growth, removal and ploughing in, of leguminous crops.

- (b) In addition to these strictly comparative experiments, the area directly cultivated for seed-growing purposes will be used for testing one or two promising varieties, methods of cultivation, or manures on a relatively very large scale.

- (c) Preliminary observations on the effect of light and heavy waterings and surface cultivation on different crops and soils will be made, with a view to re-starting the irrigation experiment.

- (d) Other experiments include the trial of machinery—chiefly harvesting machinery, of new crops such as jute, of the effect of leguminous weeds in the wheat crop, and on the inoculation of land newly sown with leguminous crops.

- (e) The work of segregating varieties of crops, especially of cotton, by growing seed from single plants separately—as has been done by Mr. Howard with the Punjab wheats, was begun last year and has now been taken up by the Economic Botanist.

- (f) Various kinds of common fruit trees will be grown under observation.

PROPOSED WORK OF THE AGRICULTURAL CHEMIST, PUNJAB, FOR THE YEAR 1908-09.

The work can be divided into two branches—

1. Educational.
2. Chemical.

1. After the completion of the laboratories of the Punjab Agricultural College, a large portion of the Agricultural Chemist's time will be given to the preparation of the courses of study which he will have to supervise and this will include the training of educational assistants.

2. Chemical work.

This includes the various problems awaiting investigation and which have, as far as possible, been placed in order of importance :—

- (a) An investigation into the composition of the alkali lands of the Province with the object of effecting a cure.
- (b) In connection with the above problem, an investigation of the type and quantity of salts absorbed by plants.
- (c) An examination of the salt wells of the Southern Punjab.
- (d) An examination of the *saji* industry (the manufacture of crude carbonate of soda from salt bushes).
- (e) Analysis of the river and canal silts of the Punjab.
- (f) The improvement of sugar manufacture.
- (g) An examination of special soils in connection with the disease hæmorrhagic septicæmia.
- (h) The most suitable conditions for setting the various fibres which can be grown in the Punjab.
- (i) An investigation into the reported deficiency of nitrogenous manure in the Hoshiarpur District.
- (j) General analytical work in connection with the experimental station.

In the meantime, before the laboratories are complete, it is proposed that the Agricultural Chemist should tour as much as possible in order to gain personal experience of the natural conditions of agriculture in the Province and of its problems in particular.

A certain amount of work is still to be done in connection with the equipment of the Chemical Department, and this will require the personal attention of the Chemist.

PROGRAMME OF WORK OF THE ECONOMIC BOTANIST, PUNJAB, FOR THE YEAR 1908.

1. Organisation of office.
2. Fitting out of Laboratories and Libraries, etc., for the Economic Botanist and students.
3. Collecting and getting knowledge of the Botanical literature of the Punjab.
4. Carrying on and extending the work of improvement of varieties of cotton and wheat already started at the Lyallpur Farm.
5. Making a survey of the indigenous cottons of the Punjab and North-West Frontier Province with a view to improving these crops by selection and hybridization.
6. Touring the Province to collect Herbarium Specimens of plants, to be familiar with the Flora and to become acquainted with the special agricultural conditions that obtain in the Punjab.
7. While touring, an attempt will be made to solve the problems put forward by the agriculturists of the districts.
8. Necessary attention will be paid to the Mycological and Entomological work of the Department if placed under the care of the Economic Botanist.

BOMBAY.

I.—AGRICULTURAL STATIONS IN CHARGE OF THE DEPUTY DIRECTOR OF AGRICULTURE.

Serial No	Name of station	SITUATION		Tract represented	Area in acres	Types of soil	Date when established	Height over sea-level	Average rainfall in inches	TEMPERATURE	
		North Latitude	East Longitude							Maximum	Minimum
1	Surat	21° 12'	72° 52'	South Gujarat	172	Black Cotton	1895	Feet About sea-level	39	105°	51°
2	Nadiad	22° 41'	73° 0'	North Gujarat	41	Alluvial Loam	1903	Do	35	111°	53°
3	Dhárvar	16° 27'	75° 6'	Karnatak	136	Black Clay and Laterite	1904	2689	32	100	50°
4	Dhulia	21° 10'	75° 20'	North Decan	28	Medium black	1905	611	22	114°	36°
5	Mavalis	22° 50'	70° 18'	Panch Mahals	58	Part red part black	1906		30	105°	41°

In addition, land has been acquired (66 acres) for a farm to be irrigated from the Gokák Canal (Belgaum District), but it is not yet started owing to want of men and funds.

2. *Continuous investigations* are being conducted on the manurial and cultural practices of the cultivators in the several districts of which the conditions on the above stations are typical. New methods and artificial manures are being tried in comparison.

3. *Selection* of the following crops is a part of the work of all stations on which they are grown, viz.:—Cotton, Jowár, Bájjí, Wheat, Tur, Til, Ground-nut.

4. *Foreign varieties* of these crops are being tried.

5. *Cotton breeding* is being extended.

6. *A Cotton survey* of the presidency is being continued and, where mixtures are grown, these are analysed.

7. *A survey of the cottons of the world* will shortly be published by the late Deputy Director (Mr. Fletcher).

8. *A wheat survey* has been initiated.

9. *Cotton wilt* is being investigated.

10. *Disease proof potatoes* are being sought for (Dhárvar).

11. *Tobacco cultivation and curing* are being investigated (Nadiad).

12. *The Spice gardens* of Kanara are being experimented on with regard to the question of leaf mould.

13. *Land Reclamation* is being attempted at Dumas near Surat.

14. *Irrigation* on several of the stations is a subject of experiment both as regards quantity of water to be applied and method of raising it.

15. *Insect Pests* are being investigated.

16. *European ploughs* are being largely distributed to cultivators at cost price.

17. *Cotton and Ground-nut seeds* are being distributed.

18. *An experiment in the manuring of pasture land* on similar lines to that about to be carried out at Pusa is being initiated.

II.—AGRICULTURAL STATIONS IN CHARGE OF THE SECOND DEPUTY DIRECTOR OF AGRICULTURE.

Serial No.	Name of station.	SITUATION.		Tract represented	Area in acres	Types of soil	Date when established	Height over sea-level.	Average rainfall in inches.	TEMPERATURE	
		North Latitude.	East Longitude							Maximum	Minimum
1	Mirpurkhas	25° 42'	69° 2'	Sind	51	Light coloured clay	1904	Feet 50	7	110°	42°
2	Daulatpur	27° 27'	69° 1'	Do	100	Alluvial sandy loam to clay loam	1907	50	7	110°	42°

MIRPURKHAS STATION.

1. This station is a representative of perennially irrigated lands of Sind.
2. The objects of this station are:—

- (1) Head-quarters of Agricultural Department in Sind.
- (2) Centre for seed distribution, chiefly Egyptian Cotton seed and Berseem or Egyptian Clover for the Jamrao Canal colonists.
- (3) A centre for demonstration plots carried out in various districts in Sind on Zamindars' own fields.

On the Farm itself the main work consists of comparative tests of Egyptian and American cottons, varietal tests of wheat, bajra, jowar, pulses, etc.

An important endeavour is being made to introduce into Sind one of the common Egyptian rotations with its improved cultivation and implements. As ordinary Sind cultivation is still in such a backward state all work is as far as possible of a simple and practical nature.

DAULATPUR STATION.

This station is a representative of the worst classes of alkali or *kalar* lands in Sind.

2. The object of this station is to prove that these *kalar* lands can be profitably reclaimed and after reclamation cultivated at a good profit. The land will be given out to Sindhi *haris* on cultivation and the work done by these on a basis of share of crop. The whole station is to be run on strictly commercial lines and similar to the work being carried on by Land Reclamation Companies in Egypt. It is expected to be useful not only as a reclamation station but also as a means of prominently bringing to the notice of Zamindars the benefit of more careful and intensive cultivation. The land is favourably situated with regard to water-supply. The analysis shows some portions of the land to contain over 3 per cent. of total alkali and is said by neighbouring cultivators to be quite unfit for cultivation under ordinary methods.

III.—AGRICULTURAL STATIONS IN CHARGE OF THE PROFESSOR OF AGRICULTURE.

Serial No	Name of station	SITUATION		Tract represented.	Area in acres	Type of soil.	Date when established.	Height over sea-level	Average rainfall in inches	TEMPERATURE	
		North Latitude	East Longitude							Maximum	Minimum
1	Mānjri (near Poona)	18° 32'	74° 2'	South Deccan	62	Medium black and light murum	1891	1,850	16	109°	45°
2	Poona Agricultural College	18° 30'	73° 50'	Do	130	Light and Medium Black	1905	1,850	32	108°	15°
3	Poona (Kirkee) Dairy and Dairy Farm.	18° 30'	73° 50'	Do.	66	Medium black and light murum	1879	1,850	32	108°	42°
4	Londavala . .	18° 45'	73° 27'	West Deccan	30	Light	1904	2,030	160	..	..
5	Phārmāsi . .	18° 8'	74° 37'	Do.	11	Light and heavy black	1900	1,774	22	..	..

MĀNJRI STATION.

Mānjri station is a Sugarcane Farm. A comprehensive series of experiments has been drawn up by a Committee composed of the officers of the Department.

Experiments to determine number of waterings, interval between them and the total quantity of water required for sugarcane continued; rotations suitable for the block system of irrigation, manurial tests, including application of farm-yard manure and safflower cake, in varying proportions and at different stages of growth: farm-yard manure, safflower cake and sulphate of potash, farm-yard manure, safflower cake and ammonium sulphate, farm-yard manure, safflower cake and calcium nitrate and farm-yard manure, safflower cake and crude nitre.

In all cases, the quantity of manure is to be measured by bulk as well as in terms of its chemical constituents instead of solely in such terms as in previous experiments. The results of sugarcane tests will be recorded as recommended by the Board of Agriculture of 1907.

Cotton and jute under irrigation are to be tried.

Tests with wheat varieties to be continued.

Gram and Jowar fodders will be grown in rotation with sugarcane.

Light shallow soil area is utilized for growing cottons of the American type, pulses, oats and barley.

POONA AGRICULTURAL COLLEGE STATION.

College Farm is devoted for demonstration to agricultural students and for students' plots.

Experiments in dry farming will be arranged.

POONA DAIRY STATION.

It is proposed to convert the Poona Station into a Dairy Farm.

Dr. Butler has a series of experiments with ground-nut Tikka disease, and one with Tur wilt. These will be continued. The rest of the area will grow fodder for the Dairy.

Breeding experiments will be continued.

LONAVLA STATION.

Lonavla rice experiments are to be continued. A new area has been taken up. The principal line of work is to investigate the principles upon which the efficiency of *rab* depends, and to find a suitable substitute.

Some work in making a survey of the rice varieties has been begun.

BARAMATI STATION.

At this station the results of experiments with sugarcane and irrigated cotton obtained at Mānjri will be demonstrated.

Rabi crops will be grown on lands flooded in the *kharif* season.

IV.—AGRICULTURAL STATIONS IN CHARGE OF THE ECONOMIC BOTANIST.

Serial No	Name of station.	SITUATION.		Tract represented	Area in acres.	Types of soil	Date when established	Height over sea-level	Average rainfall in inches	TEMPERATURE	
		North Latitude	East Longitude							Maximum	Minimum
1	Ganeshkhind gardens.	16° 30'	73° 50'	South Deccan.	80	Medium black and reddish alluvial deep loam.	1904	Feet. 1850	32	109°	45°
2	Bassein gardens	19° 20'	72° 51'	North Konkan.	90	Sandy alluvial loam.	1906	About sea level.	83	96°	61°

GANESHKHIND GARDENS.

1. A systematic collection of indigenous trees and shrubs to determine (among others) the following facts :—

- (i) The most satisfactory methods of reproduction, transplanting and treatment during growth.
- (ii) The periodical increment of growth
- (iii) Periods of leafing, flowering, fruiting and ripening of seed.
- (iv) Age at maturity.
- (v) Special investigations regarding the quality of timber, yield of the other economic products, etc.

2. Experimental introduction of rubber, fibre, medicinal plants, etc.

3. Experimental tests on exotic plants on the same lines as (1) and (2).

4. Endeavours to increase and to improve the yield of fruit trees, indigenous and also exotic, if found suitable for the Deccan.

5. Botanical research, in special natural orders, the first three to be undertaken being Malvaceæ, Leguminosæ and Cucurbitaceæ.

6. To continue the cultivation of cottons for purposes of botanical classification, also of wheat, rice, millets and pulses.

7. To attempt the improvement of a selected number of our finest wild flowering plants so that they can be used as garden plants.

BASSEIN GARDENS.

Programme of work as in the Ganeshkhind Botanical Gardens with special reference to conditions in the Konkan. While the ground within the Fort is being cleaned, advantage is being taken to study the best local methods of agriculture.

MADRAS.

On the Government Agricultural Stations the following are the chief lines of work :-

(1) *Paddy* experiments in spacing are being carried out on the Samalkota and Palur Stations and on the Central Farm at Coimbatore. The object is to find out the best number of seedlings to plant, and the best distance apart, in different soils and conditions. In most parts of the Presidency five or more, up to twenty seedlings are planted in one bunch. Experiments are also being made as to the best time to lift seedlings from the seed-bed, and the seed-rate for seed-beds. Experiments will also be made in transferring superior varieties to districts where they are not known. *Green manuring* experiments will be continued on the Central Farm, Coimbatore, and on the Palur and Hagari-Agricultural Stations.

(2) *Sugarcane*.—The testing of new varieties will be continued at Samalkota, and the best varieties will be distributed as before from the Samalkota and Palur Agricultural Stations. Mauritius sugarcanes have also been successfully grown on a small experimental plot at Taliparamba, in Malabar, where the cultivation of sugarcane is almost unknown. Manurial experiments on sugarcane will be continued at Samalkota and Palur.

(3) *Fibres*.—Experiments with jute will be continued at Samalkota, Palur, Taliparamba and Coimbatore, and it is hoped to get some more experimental plots of jute grown in Tanjore and Malabar through the local Agricultural Associations. Mr. Finlow inspected these plots last year and reported that the defects noticed in the crops were mainly due to want of experience. A specimen of *Corchorus capsularis* having been found growing in a wild state in South Canara, it seems probable that jute could be successfully cultivated on the West Coast. Experiments on *Hibiscus cannabinus* will also be continued. The subject of Sunn-hemp for fibre and green-manuring is being specially investigated by the Acting Government Botanist and a bulletin will be published in the course of the year.

The Hindupur Agave Plantation will be continued and experiments will be carried out with the co-operation of the Indian Fibre Company.

(4) *Cotton*.—The extension of the area under pure Karunganni by the distribution of pure seed on a large scale and the introduction of the drill and bullock-hoe of the Ceded Districts will be the main lines of work in the Tinnevely District. On the Koilpatti, Bellary, Hagari and Nandyal farms the most promising plants of the indigenous cottons will be selected and the seed sown next season for observation. The hybrid cottons at Bellary and Koilpatti will be treated in the same way. At Hagari various methods of planting and spacing will be tried, and irrigation experiments continued on local and Egyptian cottons. The work at Nandyal chiefly consists of rotation experiments. The various types which at present are found in a very mixed condition in the District are being grown separately for comparison.

(5) *Groundnut* at the Palur Station. Cultivation, varietal, manurial and rotation experiments will be continued. Special attention will continue to be paid to the "surul" caterpillar pest. This crop has also been tried at Coimbatore, Attur, Koilpatti, Taliparamba, Hagari and Samalkota. It appears that groundnut can be successfully grown throughout a wider range of climates and soils than was hitherto supposed.

(6) *Indigo* is being tried as a rotation for cotton at Nandyal, and the Java Natal variety is being grown on a small scale at Palur.

(7) *General*.—Cultivation experiments are being tried on several crops with a view to improving the methods of the preparation of the land, the methods of sowing or planting crops, and their after-cultivation. The measures for the eradication of the palmyra fungus disease which are being carried out under the direction of the Imperial Mycologist, will be continued.

(8) *Botany*.—The Anamalai forests will be explored for economic products, and the Nilgiris will be surveyed for plants of systematic and economic importance. Similar work will be done in the hill tracts of the Kurnool District. Fodder plants are being collected from the chief grazing districts of the Presidency, and attempts made to render available for commerce the fibres of the *nendiam* plantain of Malabar, the hull plantain of Madura, the Amitapani and Chakkarakeli plantains of

the Gódvári and Vizagapatam Districts, the pine-apples of the Simhachalam hills and the West Coast, and the *Agave vivipara* of South Canara.

Efforts will be made to introduce from the West Coast into Ganjam and Vizagapatam several varieties of edible tubers.

The process of extracting edible oil from the safflower which has already been demonstrated, will be again brought to the notice of the people in the Madura and Tinnevely Districts.

The cultivation of Sunn-hemp for fibre is being investigated in all parts of the presidency where it is grown.

(9) *Chemistry*.—The laboratories will be fitted up and prepared for the use of the students, and for carrying on the analytical work of the province. It is hoped that the following general investigations may be taken up later on:—

- (1) A systematic investigation of the tank and river silts of this presidency.
- (2) Experiments dealing with the ripening of sugarcane and the changes occurring in the juice during the period of growth.
- (3) The food requirements of plants cultivated in Southern India.

CENTRAL PROVINCES AND BERAR.

There are four Agricultural stations in these Provinces—Nagpur, Raipur, Hoshangabad and Akola. These serve a

Agricultural station. double purpose (1) as experimental stations, and (2) as central depôts from which selected seed, good bulls and improved agricultural machinery can be obtained. The Raipur station is situated in the rice tract, Akola in the cotton tract, and Hoshangabad in the wheat tract. The experiments at these stations are devised to solve problems relating to the staple crop or crops grown in the tracts in which they are situated and to introduce new ones. The crops experimented with at the Nagpur station are of a more varied type, as are also the crops of the surrounding country. This station, moreover, serves as a college farm on which the students of the Agricultural College get a practical knowledge of all the important crops grown in the provinces. At all the stations the programmes of experimental work have been revised in the light of past experience, so as to simplify the issues and improve the standard of work.

The experimental work on which the department will be engaged during the year will fall under the following heads.

2. The chief experiments with cotton are in progress at Akola under the supervision of Mr. Clouston, Deputy Director of the Southern Circle. The four

Cotton. different varieties of cotton commonly grown under the name of *jam* or *kutvilayti* will be grown separately, and the values of the outturns compared *inter se* and with other indigenous and exotic varieties suited to the conditions that obtain in the cotton tract. The rigid system of plant to plant selection already being followed with the view of improving the indigenous varieties and the exotics under trial gives promise of success, and will be continued. Other experiments deal with the spacing distances most suitable for cotton plants, the most profitable rotations with cotton, the advantages or otherwise of topping young plants to produce increased branching, of deep *reclus* shallow ploughing for cotton, and the use of artificial and natural manures. The tests of nitrate of soda and sulphate of ammonia will be continued, and the former will be applied at different times so as to find the most economical method of application. These artificials will be tried with and without cattle dung. Many exotic cottons, previously under trial, have been abandoned because they proved quite unsuitable to the local conditions, but the acclimatized American cotton received from Bengal under the name of *buri* is very promising, and will be tested on a field scale. The results from hybridization have generally been disappointing, but a few selected hybrids will be tested on a larger scale. Other hybrids will be produced, and crosses made between plants of the same variety in order to endeavour to improve the vigour of growth.

3. A collection of all the wheats grown in the provinces has been made, together with information about the tracts in which they are grown and their local reputation. The varieties have been grown pure to type, and a preliminary

classification is now in progress. The main work of the Hoshangabad station, under the direction of Mr. Evans, Deputy Director of the Northern Circle, will be the production of a variety immune to rust and at the same time of good milling quality. The pure varieties and crosses now available will be tested still further for rust resistance. Questions relating to depth of tillage, suitable rotations, manuring and the like will also be investigated at the Hoshangabad station. A special study will also be made of the varieties of pigeon-pea (*Cajanus indicus*).

4. Experiments in rice cultivation are confined to the Raipur station under the supervision of Mr. Clouston. The four different methods of cultivation are compared, viz., transplanting, broadcasting with and without subsequent cross-ploughing, *lehi* (sowing artificially germinated seed). Work will be started in the improvement of varieties by plant to plant selection of seed. As double cropping is likely to become important in rice land under regular irrigation, experiments will be designed with the view of extending the practice by introducing new after-crops and improving on the present method of cultivating the land for this crop. Experiments are also being conducted to ascertain what is the most economical quantity of water for rice in different classes of soil, and whether light waterings at frequent intervals are more economical for the less retentive soils than heavy waterings at longer intervals.

5. The rotation experiments with *Kharif* and *rabi* crops will be continued at all the stations. A study of the sorghums of the province will be started at the Nagpur station by Mr. Allen, and the improvement of the most desirable varieties by seed selection will be continued at Akola. Different varieties of sugarcane and groundnut will be tested on the Raipur farm in order to ascertain which varieties can be grown most profitably. Ground nut (*Arachis hypogaea*) promises to be a useful introduction into Chhattisgarh as a rotation crop. The experiments with jute have given promise of success both at Raipur and Nagpur, when it is sown under irrigation in April-May, and will now be tested on a field scale. The tests of Russian flax at Hoshangabad, which have hitherto given no definite results, will be continued. A beginning will be made in testing the best fodder grasses at Akola station.

6. The various series of continuous experiments with locally obtainable manures and imported fertilizers, including the experiments started with calcium cyanamide and calcium nitrate, with and without irrigation, will be continued. Leguminous crops and weeds will be tried as a green manure for wheat on a larger scale than heretofore and in the cotton tract trials will be made to grow gram as well as some of the leguminous weeds found locally as a second crop after cotton; the second crop will be sown between the rows of cotton after the last weeding of that crop.

7. The advantages of deep versus shallow cultivation for wheat and cotton will be compared. The use of Ranome's Turn Wreath plough for the eradication of *Lantana* (*Saccharum spontaneum*) will be demonstrated on one of the demonstration farms. New implements will be purchased and tried from time to time.

8. The study of the wilt disease in tur and rust in wheat will be continued. The value of *blenni* as a catch crop for cotton boll-worm will be tested. The Entomological Assistant will be free to devote all his attention to outdoor work in future. As another Assistant is being appointed to lecture in Entomology at the College. The Mycological Assistant will be mainly employed in the collection of material relating to the principal plant diseases in the province.

9. The Agricultural College will continue its educational work under the supervision of the Principal, Mr. R. G. Allen. The curriculum has been revised on the lines of the standard syllabus framed by the Board of Agriculture. Now that the prospects in the Agricultural Department have been settled by the introduction of a graded service a larger and better class of students is attracted. The Principal has been placed in charge of the Nagpur Agricultural station, so that there is ample field for practical work by the students.

10. The Agricultural Chemist will mainly be employed in teaching at the College and in the general analytical work of the laboratory. He will take up the investigation of the composition of the wheats of the province, which will be done in conjunction with Mr. Evans' investigations on wheats. He will also continue his study of the soils of the Nagpur tract.

11. The demonstration work of the Department will fall under the following heads :—

Irrigated rice farms.—Several small farms will be worked by the Department in the more backward agricultural tracts of Chhattisgarh, recently provided with irrigation from Government reservoirs. The two main objects of these farms will be to introduce the system of transplanting rice and growing irrigated *rabi* staples, both as a single and double crop, so as to induce the cultivators to utilize to the best advantage the water now at their disposal. The opportunity will be taken to demonstrate better methods of cultivation, and to introduce new crops and manures that have proved successful on the Raipur Farm. The new crops to be grown on these demonstration farms are sugarcane, jute and ground-nuts; and the manures to be tried are urine, earth, nitrate of soda, sulphate of ammonia and saltpetre.

12. *Cotton seed farms.*—The existing farms having proved a success, four new seed farms will be started this year. They will be supplied with selected seed from the experiment station, the cultivation will be carried out on special lines for seed production, and the produce will be available for seed distribution.

13. *Manures.*—In addition to the tests of manures at the irrigated rice farms mentioned above, practical demonstration will be given of the Meagher system of sewage disposal at selected towns. Co-operative experiments with nitrate of soda and sulphate of ammonia as fertilizers for cotton will be carried out by members of the Agricultural Association in the cotton tract. Some have also agreed to adopt the method recommended by the Department for conserving cattle urine and to test it as a manure for *kharif* or irrigated *rabi* crops.

14. *Prevention of smut in juar.*—The method of treating juar seed with sulphate of copper to prevent smut will be demonstrated to cultivators at fixed centres in some of the sorghum-growing districts, where the method is not yet practised. These demonstrations will also be carried out at fairs. In some tracts, this method of seed treatment has become an established agricultural practice.

15. *Improved implements.*—The use of suitable new implements, such as the winnowing, fodder-cutter, corn-sheller, Cawnpore pump and light iron sugarcane mill will be demonstrated at fairs. An Agricultural Assistant will be sent to the United Provinces to learn the Hadi process of sugar-making.

16. *Publications.*—The *Agricultural Gazette* published monthly gives the results of experimental work and such other information as is likely to be of some practical utility to its readers. Bulletins and leaflets will also be published as their want is felt.

17. *Agricultural Association.*—The meetings of the Agricultural Association are recognized means of disseminating useful knowledge and advice among the leading cultivators of these provinces. These meetings will be attended by one of the officers of the Department.

BURMA.

The Department now consists of a Director, two expert Agriculturists, an Agricultural Chemist and an Assistant Entomologist. The sanction of Government has been solicited to the entertainment of an Assistant Botanist.

2. The further organisation of the Subordinate Staff and the construction of the College and Farm buildings will continue during the year. Work will be in full swing on the Mandalay and Hmawbi Agricultural Stations. Proposals for the acquisition of a site for a dry zone farm at Meiktila have been submitted; but, for want of a trained staff, work will not begin there till the rains of 1909.

3. The details of work under the Principal of the College and the Deputy Director of Agriculture are given below. Amongst more general work the

Agricultural Survey will, it is hoped, be commenced by the Expert Staff. The Director proposes to devote a portion of next rains to a detailed study of one or more of the dry zone districts which are peculiarly liable to scarcity with a view to considering the possibility of introducing drought resisting crops or supplying local irrigation by means of wells. The development of the principles of co-operation in the purchase of seed and implements will also be considered. The Director also proposes to visit the Southern Shan States some time during the year.

4. *Agricultural Chemistry*.—A laboratory for the Agricultural Chemist is nearing completion. Mr. Warth will be engaged in training Junior Assistants and in the detailed work set forth below.

5. *Entomology*.—The Assistant Entomologist will continue his studies and collections of insects of economic value under the orders of the Principal of the College.

6. *Agricultural Education*.—It is hoped that it may be possible to complete the curriculum of the College during the year under report, as also to formulate courses for the training of Normal School Teachers, Inspectors of Land Records and Revenue Surveyors Survey School Teachers and sons of cultivators. The training of men already appointed to the Department will be continued. It is hoped that it may be possible to start the full Diploma Course by next rains, temporary accommodation being found in a part of the Director's new office and in the Chemical Laboratory.

7. *Publications*.—The issue of cultivator's leaflets and of Bulletins will be continued as the necessity for them occurs.

II.—UNDER THE PRINCIPAL, COLLEGE OF AGRICULTURE

MANDALAY AGRICULTURAL STATION.

1. *Cotton*.—A number of new varieties have been introduced and are being tested. The indigenous varieties will be selected, and endeavours to improve them by crossing with other varieties will be made. Other new varieties will, if possible, be introduced and experiments in cultivation and rotation will be commenced. Very little care is taken at present by the Burman cultivator in the growing of cotton.

2. *Paddy*.—Classification of varieties, already begun, to be continued. At present more than 250 varieties are being grown for this purpose. Experiments on watering, suggested by the Irrigation Department, will be commenced, and, if possible, rotation experiments with jute.

3. *Groundnut*.—Distribution of tested varieties and introduction of new ones. A test of all varieties grown in Burma.

4. *Jute*.—An attempt will be made to grow jute in rotation with paddy; and experiments on cultivation and the best time to sow will be made.

5. *Wheat and Barley*.—Classification of existing local varieties and introduction of new ones. Wheat-breeding may be initiated.

6. *Sugarcane*.—Trials of new varieties and methods of cultivation on the Mandalay Farm. Introduction of better methods of crushing and gur-making into the chief sugarcane districts.

7. *Jowari and Maize*.—Trials of new varieties, and selection of the indigenous varieties.

8. *Grasses*.—A continuation of the grass experiments now in progress, and the trials of other kinds, particularly the best known indigenous varieties. A continuation of the grass survey at present in progress.

9. *Rotations and Manures*.—Several rotation and manural experiments will be commenced. Green manuring and the value of bones and bat guano, now so largely exported, will be demonstrated, if possible.

10. *Implements*.—Suitable European and other implements are being introduced. Other simple and inexpensive implements are being made locally under the direction of the Principal of the College. Three of these have already been tried and proved satisfactory. This work will be continued.

11. A complete Agricultural Survey of the Province is about to be commenced, and will continue, whenever possible, throughout the year.

III —UNDER THE DEPUTY DIRECTOR OF AGRICULTURE.

(a) HMAWBI FARM.

The work on this farm will consist of—

1. *Laying-out operations.*—The experimental area will be divided by bunds into half acre fields, and these, if it be found possible or expedient, may be again subdivided for purposes of experiment. The whole farm is under water during the rains, hence bunds are a necessity, especially in manurial experiments. Such land as is not required for experiment will be sub-let to cultivators. Farm buildings will, it is hoped, be erected during the year.

2. *Experiments with paddy.*—

(i) *Varietal Experiments.*—To compare botanically and for yield the varieties grown in the Pegu, Hanthawaddy, Tharrawaddy and Prome Districts.

(ii) *Cultivation Experiments.*—To ascertain the best method of transplanting, whether in ones, twos, threes, etc., also to discover the best time for transplanting and to compare and to contrast transplanting and broadcasting.

(iii) *Manurial Experiments.*—Experiment with different plants as green manures, sunn-hemp, cow-pea, etc., will be tried. The best time of application of farm-yard manure will be the subject of an experiment, and it is also proposed to try the effects of the ordinary artificial phosphates, potash, etc., on paddy soils. The manurial value of paddy husk will be investigated.

(iv) *Native Implements.*—will be tested alongside of introduced ones and their relative merits ascertained.

3. *Experiments with Jute.*—These will have for their object to test the possibility of growing jute successfully on typical paddy soil and also to discover the proper times of sowing and cutting. A few Indian varieties will be experimented with.

4. *Experiment with sugarcane.*—This crop is grown on high lands of the delta only. The experiment will be to test the possibility of growing it on banks or on ordinary flat paddy land. Local varieties will be tried first.

5. *Grass Experiment.*—A portion of the farm will be laid under permanent pasture. This will be subsequently subjected to manurial treatment with a view to improvement. An attempt to grow English grasses may be tried on a small area.

(b) OTHER WORK.

1. *Agricultural Surveys.*—It is proposed to make a complete agricultural survey of the whole country so as to ascertain accurately the methods, conditions, resources and requirements of each district. A start will be made with the Hanthawaddy District in 1908.

2. *Demonstration of Implements.*—When the buildings are erected at Hmawbi, demonstration will be given of the use and advantage of hand thrashing machines, winnowers, choppers, etc.

This will also be done during the agricultural surveys mentioned above and cultivators, who desire such machines, will have them supplied at cost price.

3. *Winter cultivation experiments*—may be continued on areas which are so flooded in the rains that even paddy cannot be grown.

Such experiments are being tried this year at Yandoon and Hmawbi where a variety of crops have been tried.

4. *Insect and fungoid diseases*—will be noted and specimens collected and forwarded for examination and identification.

IV.—AGRICULTURAL CHEMISTRY.

1. *Examination of the Experimental Farm soils.*—

- (a) Determination of chemical composition of the soils.
- (b) Determination of physical state of the soils.
- (c) Examination of some properties of the soils.

2. *Examination of the saline matters present in some soils—*
 - (a) Determination of the composition of such saline matters.
 - (b) Determination of the relative quantities present at different times of year.
 - (c) Study of some site where alkali is accumulating.
3. *Examination of Agricultural products—*
 - (a) Sesamum and ground nut oils.
 - (b) Toddy palm juice.
4. *Investigations in connection with the utilisation of silt on the lines of Sir Edward Buck's Report will be initiated by the Agricultural Chemist in conjunction with the Agricultural Experts.*

EASTERN BENGAL AND ASSAM.

1. The programme of work for the ensuing year falls under the following heads:—
 - I. Organisation of the Department.
 - II. Experimental work at the Agricultural Stations.
 - III. Promotion of sericulture.
 - IV. Experimental work outside the Agricultural Stations.
 - V. Demonstration of agricultural improvements and dissemination of agricultural information.
 - VI. Special work of the Expert staff.
 - VII. Organisation and work of the Provincial Veterinary Department.

I.—ORGANISATION OF THE AGRICULTURAL DEPARTMENT

2. The superior expert staff consists at present of an Assistant Director, a Fibre Expert and an Agricultural Chemist. An Economic Botanist is expected to join the Department a few months hence. A Bengali Sibpur graduate, who has recently returned to India after a course of agricultural study at Cornell University in America, has been appointed an Agricultural Supervisor. It is proposed to appoint two more Agricultural Supervisors as soon as men suitable for the posts become available. Three students were sent a year ago by the Local Government for special courses in agriculture at Poona and Pusa and more will follow during the current year. It is expected that some of them will ultimately qualify themselves for appointments in the Department.

3. The expert staff will be located at the Dacca Central Farm. A most pressing work is the construction of laboratories and buildings for the accommodation of these officers and their subordinate staff. The farmsteadings has been completed and quarters for one expert and some of the subordinate staff are nearly ready. It is expected that by the end of the year all the residences of the superior staff and the greater part of the work on the laboratory building will have been completed.

II —EXPERIMENTAL WORK AT THE AGRICULTURAL STATIONS

4. There are seven Experimental stations now in the Province, viz.—

- (i) The Dacca Central Farm.
- (ii) The Rajshahi Farm.
- (iii) The Rangpur Farm.
- (iv) The Burirhat Farm.
- (v) The Jorhat Farm.
- (vi) The Upper Shillong Farm and the Shillong Fruit Garden which are worked as a single concern.
- (vii) The Wahjain Tropical Plantation.

The Dacca Central Farm and the newly opened station at Burirhat are being laid out in suitable plots for experimental purposes; the work is expected to be completed in a few months, but some of the land will not be fit for experimental work for some two or three years.

Several of the farms remain to be provided with buildings which are being pushed on as fast as local resources permit.

The programmes of work of the several stations are briefly noted below.

5. *The Dacca Central Farm.*—No programme of work has yet been prepared for this farm. It is proposed to settle a programme after consulting the Imperial and Provincial Experts at Pusa. As a basis of discussion, the Assistant Director proposes the following experiments for inclusion in the programme.—

(i) *Winter rice.*

- (a) To grow varieties to study characters.
- (b) To test, or rather to demonstrate the effect of green manuring with dhaincha (*Sesbania aculeata*) and sunn-hemp (*Crotolaria juncea*).
- (c) To test the effect of bone meal with and without the addition of saltpetre.

(ii) *New Crops*—Groundnut, flax and 3 varieties of cotton (*Buri*, Dharwar American and Spence's tree cotton).

(iii) Fertilising an upland field by continuous green manuring for two or more years on the following plan:—

1st year—*Bhadai*—Jute ploughed in.
 —*Rabi*—Sunn-hemp, ditto.

2nd year —*Bhadai*—*Dhaincha* (*Sesbania aculeata*) ploughed in.
 —*Rabi*—Oats fed off on the land.

Two acres of land may be taken, of which one may be treated as above and the other cropped in the ordinary way.

Experiments in breeding rice, maize and cotton may be initiated after the Economic Botanist has joined the Department.

6. *The Rajshahi Farm.*—The programme of work will remain nearly the same as for the current year. The new crops tried will be potato, *malancha* (*Malancha capitata*) and groundnut. There will be trials of varieties of autumn and winter rice, sugarcane and wheat and manure experiments in winter rice, sugarcane and mulberry. The scheme of manuring for winter rice is to be as follows.—

- (i) To test bone meal—6 mds. per acre *versus* no manure.
- (ii) To test green manuring with *dhaincha* instead of cow-pea (which has been hitherto used, but found not to grow well on the clay soil) *versus* no manure.

For sugarcane the manure experiments will be—

- (i) Cowdung—150 mds. per acre *plus* castor cake 21 mds. per acre, to see if the use of the additional manure is profitable.
- (ii) Super—6 mds., *plus* saltpetre 2 mds. per acre *versus* castor cake 24 mds. per acre, to see if the use of oil cake can be profitably superseded by that of mineral manures.

It is proposed to decide the scheme for experiment in mulberry cultivation after discussion at Pusa.

It is proposed to abandon the seed selection experiment with winter rice at Rajshahi and to concentrate all selection and breeding experiments at the Dacca Farm under the control of the Economic Botanist.

A demonstration of sugar making with Mr. Hadi's apparatus has been made this year at Rajshahi and Bogra. It will probably be repeated next year at some other places in East Bengal.

Experiments in jute, sida and *malancha* will be under Mr. Finlow's direction. To meet the need of steeping water the existing tank is being considerably enlarged.

7. *The Rangpur Farm.*—A new station for tobacco research having been opened at Burihat, a place 5 miles from the Rangpur civil station, it is proposed to make over the Rangpur station to the local Agricultural Association, to whom the land belongs, with effect from the 1st July 1908. The Association have not been able to decide on what lines the farm will be worked.

8. *The Burihat Farm.*—This station is to be mainly devoted to tobacco. As hitherto, the main object will be to produce tobacco suitable for the manufacture

of cigars and cigarettes. A large number of exotic and indigenous varieties of tobacco are being cultivated—the treatment of the crop as regards manuring, spacing, topping and suckering, as well as the subsequent operations of curing and spacing, being varied according as the leaf is intended to be used as cigar wrapper or filler or for the manufacture of cigarettes. A small area of Sumatra tobacco is grown under shade, following the practice which has largely come into vogue in the United States.

Besides these attempts at producing tobacco suited for expensive cigars and cigarettes, it is also intended to give special attention to the production of tobacco suitable for cheap cigarettes.

Besides tobacco there will be experiments with different varieties of ginger and potato, both being important crops in the Rangpur district.

Groundnut will be tried as a new crop.

9. *The Jorhat Farm.*—This farm is to be devoted mainly to the sugarcane crop. A programme of sugarcane experiments for the current year was decided in consultation with Dr. H. Mann in April 1907. It is proposed to follow the same programme with some slight modifications in the ensuing year. The programme includes—

- (i) An experiment to test the merits of a number of varieties of sugarcane. There will be some fourteen varieties under trial in the coming year, four among these being seedling varieties imported last year from Barbadoes. The experiment includes a continuous detailed study of the field characters of each variety during the growing season.
- (ii) An experiment to ascertain the most profitable amount of cattle manure and oil cake to apply; the manures tried being as follows:—
 - (a) 300 mds. of cowdung plus 20 mds. of rape cake per acre.
 - (b) 150 mds. of cowdung plus 10 mds. of rape cake per acre.
 - (c) 75 mds. of cowdung plus 5 mds. of rape cake per acre.
 - (d) 300 mds. of cowdung and no oil cake per acre.
 - (e) 150 mds. of cowdung and no oil cake per acre.

To these it is intended to add experiments with fish manure, green manure, cotton seed cake and whole cotton seed.

- (iii) An experiment in ratooning on the two plots planted with varieties in the current year. Most of the plots ratooned this year will also be maintained for a third year.
- (iv) A selection experiment consisting in selecting the 20 best cuttings of each variety picked out from the healthiest clumps of cane in the variety plots.

The attempt to free from disease certain varieties of cane which are extremely susceptible to red rot by carefully excluding every set that may show the least trace of reddening at the cut ends will be continued.

The programme of the farm will include the cultivation of groundnut as a new crop, of potatoes and of several exotic varieties of pineapple and of plantain, orange, lime, litchi and mango trees. It will also include demonstrations intended to bring home to the local raiyats the advantages of the 3-roller iron sugar mill and the shallow evaporating pan over the wooden mill and deep pans used by them.

The Upper Shillong Farm and the Shillong Fruit-Garden.—The programme will be as follows:—

(i) *Potatoes.*—

- (a) Trial of varieties.
- (b) Experiments to test the merits of
 - (i) boxed against unboxed seed
 - (ii) whole against cut sets
 - (iii) large against medium sets.
- (c) Trial of Bordeaux mixture as a fungicide. This may be said to have passed the experimental stage. Arrangements are being made to demonstrate the value of Bordeaux mixture in a number of raiyats' fields in the ensuing season.

(d) Manure Experiments:—

(i) Green manure with pulse crop *versus* no manure.

(ii) Rape cake—20 mds. per acre

versus

Super—6 mds.

Sulphate of Potash 3 mds.

} per acre,

both fields receiving 150 mds. of cow dung in addition.

(ii) *Introduction of European fruits and fruits of the semi-temperate climate.* These include apple, pear, cherry, plum, apricot, peach, grape, strawberry, gooseberry, raspberry, currant, fig, walnut, almond, loquat, tree tomato, cherimoyer and mountain papaya.

(iii) *Distribution of trees and seeds* of such new fruits and vegetables as have proved successful. These include pear, strawberry, fig, Spanish chestnut, rhubarb, asparagus, mulberry, varieties of potato, and a large fruited variety of squash.

(iv) *Trial of new crops.*—Three varieties of American sweet potatoes, Jerusalem artichoke, mangel wazel and groundnut.

(v) *Breeding of maize.*—By cross-fertilising local with superior American varieties.

(vi) *Preservation of fodder in soils.*—As an object lesson to Khasia cultivators.

(vii) *Cattle-breeding.*—Efforts are being made to introduce a good milking strain of cattle and to improve the local Khasi breed by crossing it with a half English Putna bull. The farm will continue to distribute young bulls of its own breeding to cattle breeders in the District. The Superintendent of the Veterinary Department will constantly inspect and advise on the breeding operations.

(viii) *Sericulture.*—The cultivation of mulberry will be continued, as well as the experiment in the rearing of the univoltine silkworm, both from fresh imported seed and from seed locally produced. It has been proved that European silkworms can pass at least one year in Shillong without deterioration or increase of disease. It is now intended to ascertain whether the reed of the same worms gives equally good results in the third year. To introduce sericulture in the Khasi Hills, one Khasi boy has been sent with a Government stipend to the sericultural school at Rajshahi. He has bound himself to commence rearing silkworms on his return after completing the normal course of training at the school. Next year it is expected that two more Khasi boys will be sent for training.

11. *The Wahjain Tropical Plantation.*—The plantation will continue to be used as the trial ground for various species of tropical spices, drugs and fruits. These are as follows:—

A. *Spices*—

Cinnamon,
Lesser Cardamom,
Greater do.
Nutmeg,
Clove.

B. *Drugs*—

Coffee,
Cocon.
Camphor.

C. *Fruits*—

Oranges and other citrus fruits,
Pineapple.
Papaya,
Grafted mango,
" litchi,
Sapota,
Banana,
Bread fruit,
Rambutan,
Soursop,
Cherimoyer.

D. Essential oils—

Lemon grass.

Tezpat (leaf of a species of Camunon).

The plantation is situated on the southern slopes of the Khasi Hills which are the home of the Sylhet orange. A very serious blight has appeared in the orange groves, which has already killed a vast number of trees, and is spreading fast. Dr. Butler was good enough to send one of his assistants, Mr. S. K. Basu, in May last to investigate the pest. His report has not yet been received, and no remedial measures have as yet been suggested. The blight is believed to be the work of a fungus which spreads underground from tree to tree. It has been observed that several species of citrus, though growing in close association with diseased orange trees are free from the blight. Experiment is being made to confirm this observation by planting a large number of citrus trees of different species in a badly diseased orange garden. If any of these species prove immune to the attack of the fungus, it will be possible to combat the blight by using them as stocks for grafting the orange on. Previous attempts at grafting orange on such stocks have however failed, and information is desired as to whether skilled grafters can be obtained from the Central Provinces or elsewhere to conduct further experiments.

III—PROMOTION OF SERICULTURE.

12. It has been decided that this province, while working in concert with Bengal in measures for the revival of the silk industry should have a separate staff for the purpose. This department is therefore taking over from the Bengal Silk Committee the charge of all sericultural operations in the districts of Eastern Bengal, including the two small pure-seed stations in Rajshahi. These it is intended to supplement shortly by two large rearing stations, one in Rajshahi and the other in Bogia, each controlled by a responsible officer of the grade of Sericultural Superintendent. One such officer after passing through a course in sericulture in Tokio University is now receiving special training in Indian methods under Mr. A. K. Ghose, Sericultural Superintendent of Bengal.

The sericultural school at Rajshahi will be continued on the lines already established last year. Twelve apprentices are received who must be sons of silk-rearers. After a year's training each apprentice who proves himself thoroughly competent is awarded a microscope together with a sum of Rs. 250 with which to build a model rearing house. It is expected that the number of students will be increased to twenty from January 1909, when probably six students will be received from Bengal, and two from the Khasi Hills.

IV—EXPERIMENTAL WORK OUTSIDE THE AGRICULTURAL STATIONS

13. The programme of work outside the Agricultural Stations will include helping Government Officers in making experiments in Government and wards' estates with advice as well as with seeds, manure, etc., and rendering similar assistance to private individuals wishing to try new crops, manures or implements. There are several private experimental farms in the Province which are being worked in co-operation with the department and will continue to receive its assistance.

14. An important branch of work, not directly connected with any Agricultural Station is the investigation of insect pests and the application of remedies wherever possible. The Department has in its employ an Entomological Collector who received his training under Mr. Lefroy at Pusa. It is proposed to issue a small handbook in the chief vernaculars of the province, of more important insect pests locally known for which practicable remedies can be recommended.

15. In some parts of the province the rearing of poultry and ducks and the sale of eggs are important industries. It is intended to make some experiments on the rearing of improved breeds and in the introduction of improved methods of preserving eggs. Some of these experiments will be made by officers of the department, others will be made by private persons and officers of other Departments with our advice and help. In all cases the experiments will be on a modest and tentative scale, until experience has shewn the lines on which larger operations can be undertaken with full expectation of ultimate benefit to the country.

16. The supervision of measures for the improvement of the hand-loom industry has received a large share of the attention of the officers of the department during the past year and it is probable that during the ensuing year this work will be largely developed.

17. During 1907 the department was charged with the duty of arranging for the planting of avenues in the new civil station of Dacca. It is probable that shortly the department will be directed to supervise the roadside arboricultural operations of the whole province.

V — DEMONSTRATION OF AGRICULTURAL IMPROVEMENTS AND DISSEMINATION OF AGRICULTURAL INFORMATION.

18. The Department hopes to receive considerable assistance from its Honorary associates and correspondents in disseminating useful agricultural knowledge and in obtaining timely information of pests, blights and other calamities affecting crops, with a view to taking such steps as may be possible towards devising remedies. Some associates and correspondents have already been appointed, and it is proposed to extend the number as gentlemen qualified to do the work expected of them become available. An Honorary correspondent is expected to send regularly to the Department reports on all matters affecting crops and, in return, he is supplied with all information likely to be useful to the agriculturists of his neighbourhood. An Honorary Associate in addition to the duties of an Honorary correspondent is expected to make a comparative demonstration of an agricultural improvement which has been already proved by experiment.

19. The demonstrations to be taken up at present have been described in a bulletin (No. 16) issued by the Department. Materials for a bulletin on the cultivation of the potato, another on the cultivation of coffee in the Khasi Hills and a third on the use of Bordeaux mixture as a fungicide, particularly with reference to the potato disease, are being collected by the Assistant Director, and will be soon ready for publication.

20. Agricultural exhibitions which are an important means of spreading a knowledge of new crops and new agricultural practices will continue to receive assistance from the Department.

21. The compilation of agricultural statistics and the improvement of the present system of collecting figures for crop forecasts will require and receive considerable attention from the officers of the Department.

VI — SPECIAL WORK OF THE EXPERT STAFF.

22. Mr. Finlow will continue, in collaboration with the Reporter on Economic Products, the chemical and agricultural study of the various races of jute, having regard to quality as well as yield of fibre. The selection experiments with jute will be continued and, if possible, some cross fertilisation experiments will be made. Mr. Finlow will also be required to advise on measures for the extension of jute cultivation to parts of this province where, though the land is suitable, the crop is not at present grown. Mainly to assist in these measures he will maintain and distribute a sufficient supply of first class seed. He will also continue to visit other provinces where his services are required in connection with jute experiments.

23. During 1907 Mr. Finlow, in collaboration with Messrs. Cross and Bevan of London, commenced an investigation regarding the deterioration of damp baled jute. This will be continued and possibly completed during the year.

24. Further experiments will be made with flax cultivation and retting. The study of various fibre yielding plants indigenous to this province will be developed. It is hoped that a bulletin on the latter subject will be published during the year.

25. One of Mr. Meggitt's important duties will be to see that the construction and fitting up of the Central Laboratory at Dacca are brought to a speedy and satisfactory conclusion. Meantime from June next he expects to have the use of the old Dacca College laboratory.

26. The Local Government have asked that an enquiry should be taken up in regard to the value of the silt deposits on land annually inundated by rivers. One branch of this enquiry relates to the effect of embankments in depriving the fields of further supplies of silt. The details of the enquiry have not yet been settled. It is intended that this should be done after consultation with the Imperial Experts and officers of other provinces at Pusa. The enquiry when taken up will be in Mr. Meggitt's charge.

27. The Agricultural Chemist will also be required to continue the analytical work commenced this year in connection with sugarcane experiments. Many other analyses of soils, manures and plants will also have to be made.

VII—ORGANISATION AND WORK OF THE VETERINARY DEPARTMENT

28. The Secretary of State having now sanctioned the formation of a Veterinary Department in this province, it is expected that great progress will be made during the year in veterinary work. At present there are under the Superintendent, one Inspector and 28 assistants. Within 1 or 5 months it is hoped that these numbers will be increased to 2 Inspectors and 48 assistants. The inspection and instruction of the new assistants will occupy most of Mr. Harris' time. He is also required by Government order to inspect and test all glanders and surra cases before any animal is destroyed under the Act.

29. An excellent site has been obtained for the Veterinary headquarters and laboratory between the new and old civil stations of Dacca. The construction of buildings will, it is hoped, be well in hand by the end of the year.

30. The special staff of inoculators under a qualified European Veterinary Surgeon will be maintained for a further period of one year in the Sarina Valley where great progress has already been made in driving out the epidemic of rinderpest which had been working untold havoc among the cattle.

BARODA.

1. There are now four Farms—one Experimental and three Demonstration Farms in the State. The crops experimented with at the Baroda Model Farm are of a more varied type, as are also the crops of the surrounding country. This Farm, moreover, serves as a school farm on which the students of the Agricultural school get a general knowledge of all the important crops grown in the State. The three small Demonstration Farms are worked by the Department in the more backward Agricultural districts with the object of demonstrating better methods of cultivating certain crops, or of introducing new ones. The experimental work on which the Department will be engaged during the year 1908-09 will fall under the following heads:—

2. Manure experiments on Tobacco and Sugarcane were started last year with the intention of ascertaining whether any artificial manures can be economically successful so as to replace manures locally obtainable. For this, complete manure formulae were made up for equal cost. This being the first year of the experiment, no results were deduced. The experiment will be continued.

3. Sowing of white Egyptian cotton at various dates was tried. That started in March gave 600 lbs per acre, while that sown in June gave only 240 lbs. The experiment will be continued.

Special experiment with brown Egyptian cotton without irrigation was tried in people's fields in various kinds of soil. The results show (1) that the best black soil of Gujrat is suitable for this crop; (2) that the heat of October—November forces this cotton to early maturity and the bolls thus formed attract boll-worms; and (3) that by removing tops and October flowers as they are found, good crops may be hoped for.

The trial will be continued now on a small scale under direct control of the Department in the best black cotton soil.

4. The seed of big Japanese groundnut which gave the best yield as an unirrigated crop has been given to the best cultivators and Travelling Instructors with printed leaflets of instructions. Efforts will be made to make this crop popular

- Cheese 5. The Cheese-house which was under construction last year is now complete for making cheese and for utilizing Skim Milk.
- Cross breeding. 6. Cross breeding between English and Indian cattle will be tried.
- Seed Depôts 7. The number of Seed Depôts for the selection and distribution of seeds of ordinary crops will be increased.
8. The insect diseases of tobacco, rapeseed, sesamum, gram, cotton, sugarcane were studied. Useful particulars about the cotton bollworms and Katra have been printed in Gujarati leaflets.
- Entomology. 9. The Mulberry plantation was extended at the Songhad Sericultural Farm to meet the growing demands of people for propagation. Six crops of silk worms were taken last year and forty students have received instruction in rearing and reeling. It is hoped that these students will take up the new industry, as special concessions are given.
- Sericulture 10. Revised course of studies in the School of Agriculture will be introduced from this year.
- Agricultural Education 11. Three more Experimental Farms will be opened before the end of this year for special experiments of cotton, poppy and sugarcane at Dabhoi, Sidhpur and Navsari, respectively.
- Experimental Farm 12. To induce the cultivators to make use of English implements, Turn Wrest Ploughs B.T. 2 are given on loan with skilled labour of the farm to well-to-do farmers. They tried these ploughs on their own lands and have promised to buy some ploughs.
- Introduction of English Ploughs. 13. This year to economise water on irrigational crops, side-irrigation is tried on sugarcane, wheat, tobacco, English vegetables, potatoes, etc. The whole is still in experimental stage, but the present outlook of all the crops is very healthy and it is expected to give a better yield.
- Side-irrigation. 14. It is proposed this year to inoculate the farm yard manure with Nitrogen-bacilli and to compare this manure with other artificial Nitrogen manures: if possible, the inoculated manure will be distributed to well-to-do farmers for trial.
- Inoculation of manure.

KASHMIR.

1. Experimental work at the Pratap Model Farm to be continued on the following points:—

1. Variety experiments with—

- (a) Wheat.
- (b) Oats.
- (c) Gram.
- (d) Peas.
- (e) Mustard.
- (f) Shali.
- (g) Cotton.
- (h) Muize and juar in alternate plots.
- (i) Tobacco.
- (j) Potatoes.

The object of the variety experiments being to discover varieties suitable to the Kashmir Valley and superior to those commonly grown.

2. Russian linseed (Riga) for fibre. Experiments were made with Riga to see if it could successfully be grown for fibre in Kashmir. The seed was obtained from the Department of Agriculture, Eastern Bengal. The sowing was delayed

over a fortnight owing to severe rains. The cultivation too was unsatisfactory owing to want of the proper implements. A sample of fibre, as grown, was sent to Messrs. Ogilvy, Gillanders and Company, London, for favour of opinion, which is given as below:—

“Codilla, rough, strawy, mixed strength, value £13 to £14 per ton; owing to the irregularity of the sample, it is valued lower than it would be, if stored.

If the product was carefully stored, a varying proportion of ‘Line’ (which means fine quality) would be obtained, which at present is valued £20 to £30 per ton and ‘Codilla’ at a proportionate price.”

3. Manual experiments with—

- (a) Wheat.
- (b) Mustard.
- (c) Peas.
- (d) Paddy.
- (e) Oats.

The manures to be tried in each case are those which are easily procurable by the cultivators of the Valley. They are as follows:—

Horse dung; cattle dung; farm-yard manure; Dal soil; ashes of chinara leaves.

The Electric Department of Jammu and Kashmir State expects to produce nitrate of lime at a very cheap cost.

4. Green manuring *versus* Farm-yard manure.

- (a) Two plots Wheat after urd-fodder ploughed in.
- (b) „ Wheat after moong-fodder ploughed in.
- (c) „ Wheat after hemp ploughed in.
- (d) „ Wheat after beans ploughed in.
- (e) „ Wheat after application of 100 maunds farm-yard manure
- (f) „ Wheat without any manure.

The object is to see whether green manuring could quite as well and economically serve the purpose of farm-yard manure, which is very difficult to get sometimes at any price.

5. Norfolk rotation of Four Course System.

- First year.*—Wheat.
- Second year.*—Potatoes.
- Third year.*—Oats.
- Fourth year.*—Lucerne.
- Fifth year.*—Same as first year, and so on.

6. Two-year rotations:—

- (a) Two plots. Wheat and beans in alternate years
- (b) „ Wheat and guar do.
- (c) „ Wheat and peas do.
- (d) „ Wheat and urd do.
- (e) „ Wheat every year.
- (f) One plot. Wheat-mustard every year.
- (g) „ Wheat-gram every year.

7. Dofash rotations:—

- (a) Two plots. Wheat after urd-fodder removed.
- (b) „ Wheat after moong removed.
- (c) „ Wheat after hemp removed.
- (d) „ Wheat after beans removed.
- (e) „ Oats after urd removed.
- (f) „ Peas after guar removed.

Further work proposed to be done by the Agricultural Department of Kashmir State is —

- II. Organization of the Department.
- III. Trial of the following new crops :—Groundnut, juar, bajri, [finer paddy and lucerne.
- IV. Seed selection and distribution of ordinary crops.
- V. Trial of the Watt's and Meston ploughs and other agricultural implements likely to be more serviceable to the cultivators of the Kashmir Valley.
- VI. Cattle-breeding. Efforts will be made to improve local breeds of cattle by the distribution of stock from the farm.
- VII. Arrangements are being made for a seed farm.
- VIII. A Live Stock and Agricultural Show was held in Shrinagar on 18th and 19th October 1907 for the first time. It was fairly successful, and it is arranged that one should be held every year to encourage the cultivators and the zamindars of the Valley.
- IX. Introduction of European fruits and vegetables in the State gardens.

APPENDIX D.

PROPOSALS FOR THE EXPANSION OF THE DIFFERENT SECTIONS OF THE PROVINCIAL DEPARTMENTS OF AGRICULTURE.

The rates of pay fixed for the higher posts for Indian assistants at Pusa are not sufficient to attract and retain the best available men. It is equally certain that better rates of pay would attract better Indian assistants to the Agricultural Department of each Province, and would prevent them, after passing through the course in Agriculture, from eagerly seeking employment in other Departments as at present.

2. Until the best Indian assistants are employed for laboratory, class room and field work, it is uncertain that reliable original agricultural work will be done by them and probably ordinary routine work will also suffer.

3. Field and other practical experiments must always be largely supervised by Indian assistants. If this supervision is inadequate, the recorded results must be worse than useless.

4. The men we want should have been brought up on the land and should have obtained a good general education as also a technical education in some branch of the Department. The rates of pay for Indian assistants in the Agricultural Departments should be graded to use as high as those in the Revenue Department.

5. I submit below a scheme to provide a sufficient native agricultural establishment for each Province. I hope it will be accepted by each Local Government without material alteration as the basis to which each Province can work up gradually. If Local Governments generally accept my proposals, we will have a strong case to put before the Secretary of State. The rates of pay and prospects should, as far as possible be fairly uniform for all sections of the Department in each Province.

6. The work in each Province should be approximately as follows :—

- (a) Research and tuition in the College and in the field of the College Farm and to some extent in the districts.
- (b) The practical application in the field of research and experimental discoveries of proved value, the extension of improved varieties of crops, of improved methods of cultivation or other improvements from the experimental plots through demonstration areas to the cultivator's fields, the study of the variable and fixed natural conditions and their influence on agricultural possibilities and the collection of general agricultural facts.

7. For the work classed under (a) the following European staff was proposed by the Government of India to the Secretary of State :—(1) an all-round Agriculturist to be Principal of the College ; (2) an Agricultural Chemist ; (3) an Economic Botanist ; (4) a Mycologist ; (5) an Entomologist. The Principal of a Provincial College need not necessarily be an expert Agriculturist. Another expert on the staff might be a better man for the post. The Principal should reside at the College, but the other members of the staff will be able to tour to a considerable extent and all should be in continuous communication with the Deputy Directors of Agriculture, so that research work can be, as far as possible, based on practical information gathered in the field.

8. The Provincial posts of Mycologists and Entomologists have not been sanctioned by the Secretary of State. It is therefore necessary to get these sections of work done in each Province by the best Indian agency which is procurable.

9. Each European Expert, who at a Provincial College is a Professor of a particular subject, should have an Indian assistant thoroughly capable of teaching and also of guiding the laboratory work of the students.

10. In every Provincial College provision should be made for the teaching of Physics, Geology, Agricultural Mechanics, Surveying, Plan Drawing, Book-keeping and to some extent Veterinary Science in addition to the main subjects, *viz.*, Agriculture, Chemistry, Botany and Mycology.

11. I summarize below the Indian establishment required at each Provincial College and Research Station :—

Principal and Agriculturist's Section.

1 Assistant Professor of Agriculture	250-10-500	
1 Farm Manager	200-5-250.	
1 Teacher of Physics, Agricultural Mechanics and, if necessary, Mensuration and Mathematics.	150-5-250.	
1 Teacher of Surveying, Plan Drawing and Farm Book-keeping	100-5-150.	
1 Veterinary Assistant for teaching and also in charge of the District Dispensary.	100-5-150.	
2 Field Assistants	75-5-125,	each.

Agricultural Chemist's Section

1 Assistant Professor of Chemistry and Geology	250-10-500	
1 Laboratory Assistant and Demonstrator	150-5-250.	
2 Laboratory Assistants	100-5-150,	each.
2 Ditto	75-5-125,	„

Economic Botanist's Section

1 Assistant Professor of Botany	250-10-500.	
1 Laboratory Assistant and Demonstrator	150-5-250	
2 Field Assistants	75-5-125,	each.

12. Since the Secretary of State has not sanctioned the appointment of European Mycologist and Entomologist for Provincial service, Dr. Butler and Mr. Lefroy have made proposals which provide the following Indian staff in each Province. Full explanations are given in Appendices to this note :—

Mycology

1 Assistant Mycologist and Teacher (when necessary)	250-10-500.	
1 Laboratory Assistant and Demonstrator	150-5-250.	
2 Field Assistants	75-5-125,	each.
1 Fieldman	30-1-50.	
1 Collector and Munter	10-2-30.	

Entomology

1 Assistant Entomologist and Teacher (when necessary)	250-10-500.	
1 Laboratory Assistant and Teacher	150-5-250	
3 Field Assistants	100-5-150,	each.
4 Ditto	75-5-125	„
2 Setters	30-1-50,	„
7 Fieldmen	10-2-30,	„
1 Laboratory keeper	10-2-20.	

13. The work of the Provincial Mycological and Entomological Assistants should be supervised by the Economic Botanist. Therefore efforts will be made to appoint to each Province an Economic Botanist of proved experience in original and practical work.

14. It should be recognized that it will take years to work up to an effective staff of Indian assistants, but definite rates of pay should be fixed at once to attract the right men. I consider that agricultural improvement in India depends largely upon the proper training of Indian assistants.

15. I strongly believe that the senior assistant of each European Expert of each Provincial College should be trained partly in England until Pusa rau undertake this training. Each should be a graduate in Agriculture of an Indian College and be deputed to the Cambridge University for two years on a pay of Rs. 200 to take his degree in Agriculture and afterwards to specialize in his own particular subject. Experience has shown that selected students, who have graduated in Agriculture in India, have no difficulty in taking the Cambridge degree in Agriculture in a year and are then free to specialize in Economic Botany, Agricultural Chemistry or any other Agricultural subject in the other year. Each student should then have one year's further training at the Pusa Research Institute. The training

at Pusa will, by the time men are ready, be as good as that at Cambridge and directly suited to Indian workers. The other posts of my list down to those on pay Rs. 75-5-125 should be filled by graduates in Agriculture of an Indian College who should also in special subjects get a further special training at Pusa (for instance in Mycology or Entomology).

16. In (b) section of Provincial Agricultural work referred to in paragraph 7 of this note, the Deputy Director of Agriculture requires a sufficient number of Assistants as Farm Superintendents, Overseers and Fieldmen. The number should increase as work develops. I propose the following rates of pay :—

Superintendents of Experimental Stations and Seed Farms	200-5-250
Overseers of Demonstration Areas	100-5-150
Fieldmen	75-5-125.

In all cases these men should be chosen from the Agricultural graduates of Indian Colleges. A Fieldman may of course be gradually promoted to be a Superintendent.

17. It is unnecessary for me to discuss the range of work of Deputy Directors of Agriculture and of European Experts attached to Provincial Colleges and Research Stations. The work will be largely influenced by the originality and individuality of each man, but will be guided of course very materially in each Province by the consultation between the Experts and the Directors of Agriculture.

18. At Pusa full arrangements have been made for the illustration work of each section. Coloured and other illustrations can now be clearly reproduced in India and arrangements are being made so that coloured plates representing the life history of destructive insects will be supplied for leaflets or other publications to be issued by Provincial Agricultural Departments or by vernacular papers or otherwise at Rs. 30 per thousand and similar arrangements can be made in any other section.

J. MOLLISON,

Inspector General of Agriculture in India.

APPENDIX I.

A summary of some information obtained from the Imperial Mycologist regarding the expansion of his work in different Provinces.

The Secretary of State has not sanctioned a European Mycologist for each Province ; therefore highly-trained Indians must do the work.

2. The need for Mycological enquiry regarding Indian crops is great. Rust causes immense loss to cereals and to linseed almost every year. Smut is also very prevalent in cereal crops and grasses. The palm disease in Madras has already caused loss amounting to 20 lakhs of rupees or more. The Betel Palm plague in Eastern Bengal is still more disastrous. Many other plant diseases affect the prosperity of agriculture in India. The cost of Dr. Butler's section would be met for many years by checking one of the major diseases which affect our agricultural crops.

3. He draws a distinction between the immediate results of the work of his section and of some other branches of agricultural science in India, because before his time there were no previous workers in India in Agricultural Mycology except Dr. Barclay and Dr. Cunningham ; and because Mycology in relation to agricultural plant diseases is yet only a new science particularly in the tropics.

4. There is not a general treatise which deals with the fungus diseases of the tropical agricultural plants. Dr. Butler is preparing one and it is almost ready for the press. He has issued many clearly illustrated articles which deal with particulars of his work. Complex plant diseases are not necessarily the most difficult feature of Dr. Butler's work. He says there is often a stage in the life history of a plant parasite in which destructive measures are possible, and with full knowledge once gained a decision can easily be made upon the beneficial lines of work.

5. The first requirement for Mycological work in India is full provision for research. This, for the present, must be arranged for at Pusa. It is a very big undertaking, considering the agricultural area and the number of crop diseases which have to be dealt with. For research and general work at Pusa and throughout

India 3 European Mycologists and a full staff of Indian assistants will probably soon be employed.

6. The present Indian staff of the Mycological section at Pusa, excluding clerical and menial establishment, consists of—

	Rs	
1 First Assistant	200-250	
2 Assistants	75-125,	each
1 Fieldman	50-75	
2 Fieldmen	30-50.	each
1 Assistant (for Supernumerary Mycologist)	75-125	
2 Assistants (trained for and employed by Provincial Departments).	100,	each

7. Experience has proved that better rates of pay are required to attract and keep first class Indian assistants. Proposals have been made for such improved pay.

These proposals are—

	Rs	
1 First Assistant and Teacher	300-600	
1 Second Assistant	250-300	
1 Third Assistant	200-250.	
3 Assistants	100-150,	each.
1 First Fieldman	50-75	
2 Fieldmen	30-50,	each
1 Assistant to Supernumerary Mycologist	75-125	

8. The Indian staff above referred to is required for field and laboratory work connected with research and also for teaching students sent from Provinces.

9. The establishment at Pusa of a central reference collection and library in Mycology is receiving particular attention, as it is of the first importance that the Mycological workers in India should get fungus pests identified at or through Pusa and get other assistance there. The demand for information is keen from officers in the Forest and other Civil Departments and also from men in the Provincial Agricultural Departments.

10. The work of the Pusa staff will chiefly for some years refer to—

- (a) Scientific research in plant diseases and their remedies and other problems such as the action of the fungi in the soil. It is from such enquiries that practical measures of treatment are chiefly expected.
- (b) The study of the fungus flora of India and arrangements for a central reference collection which will aid Provincial Departments in the determination of their pests and in the study of life histories and in teaching students.
- (c) The publication—
 - (i) of the results of research work in specific diseases,
 - (ii) of descriptions with illustration of Indian fungous affecting agricultural crops,
 - (iii) of the results of remedial measures.
 - (iv) of popular articles in the Agricultural Journal of India or in leaflet form, the object of these being to indicate to educated landowners and agriculturists how the work of the section can be applied to practice in the field.
- (d) The training of men for Provincial work.
- (e) The co-ordination of work in the Provinces.
- (f) The conduct of campaigns too large for the Provinces to deal with unaided.

11. The staff required in each Province should for the present be as follows :—

	Rs.	
1 Assistant Mycologist and Teacher (when necessary)	250-500	
1 Laboratory Assistant and Demonstrator	150-250	
2 Field Assistants	75-125,	each.
1 Fieldman	30-50	
1 Mounter	10-30.	

12. The Senior Assistant in each Province should be a selected student of an Indian Agricultural College who is of the landholder class and who should be, if possible, a science graduate of an English University. The most satisfactory training possible would perhaps be that required for the Agricultural Diploma of Cambridge University, provided that the student devotes special attention to Mycology during the course.

13. The laboratory assistant required is the class of men who have been sent to Pusa by several Provinces for training, in the past two years. These men are graduates of Indian Universities who go through a course of about 18 months training at Pusa. When the Provincial Colleges are equipped, picked students from them with a considerable further training at Pusa will be available and should prove satisfactory. Men whose upbringing has been on the land should be sought.

14. The two field posts should be filled from the Agricultural Colleges in India, with some further training at Pusa.

15. The whole of this part of the proposals relating to the pay, selection and training of Provincial Assistants must be dependent, to some extent, on the special conditions and preferences of the Provinces concerned. It is impossible to lay down any hard-and-fast rules.

16. The duties of the Provincial Assistants should chiefly be connected with practical matters and should not particularly refer to original research. These Assistants should make enquiries in the field regarding any crop diseases, their seasonal prevalence, amount of the damage done, methods of checking adopted by cultivators, practicability of introducing other remedial measures and should adopt such measures on recognized lines, as far as possible, on the Government Farm and in cultivators' fields. They should collect specimens of the fungi of the Province which are harmful to agriculture and form teaching collections for the Provincial Agricultural College. Duplicate specimens should be supplied to Pusa to be identified.

17. In each Province the Assistant Mycologist and his Assistants should work under the Economic Botanist who alone will have sufficient knowledge to properly direct the work.

18. Since, for a part of the year, the presence of the two first assistants will not be essential at head-quarters, they should keep in close touch with field-work and carry out detailed enquiries into such serious diseases as are reported by the Field Assistants or otherwise. It is impossible to separate the field and laboratory branches of Mycological work. The two must be brought together by the frequent touring of the Assistant Mycologist and Laboratory Assistant. When large field work has to be taken up, as in a campaign against a specific disease, the field staff must be strengthened from the laboratory, and microscopic work in the field should form a prominent feature of such work when the full characters and life history of the disease are not thoroughly understood. All arrangements for the supply of spraying and steeping materials and the like should be made by the Assistant Mycologist.

19. The Field Assistants should be occupied in disseminating information, making enquiries, visiting villages to inculcate simple practices for checking or avoiding disease and such other purely field work. They must keep in constant communication with the laboratory for the identification of specimens and for other useful information. The fieldmen should chiefly carry out practical remedies requiring no special scientific knowledge.

20. The broad lines of work in each Province should be arranged in consultation between the Imperial Mycologist and the Provincial Botanist. Pusa should be kept in advisory touch with the Provincial Assistants so as to co-ordinate work and prevent overlapping. Monthly reports should be submitted by the Assistants, a copy being forwarded to the Imperial Mycologist for information and remarks.

21. As a specific instance of how this scheme of departmental organization should be applied in practice, Dr. Butler's description of the work at present being carried out by the Madras Department of Agriculture under the advice of the Imperial Department is given as Appendix II.

APPENDIX II.

The field campaign against the Palm Disease of the Godavari Delta.

The Godavari Palm Disease was first noticed by the people of the Delta about ten years ago. It was then confined to a few villages, but has extended steadily since, and in August 1905, when I visited the Delta to investigate, it occupied an area of about 900 square miles.

In the early years palmyra palms alone were attacked. Subsequently it spread to coconut and probably also to areca palms. These palms formed the chief feature of the Deltaic landscape, and in those localities where the disease has existed for several years, the sight of thousands of dead naked poles is extraordinarily impressive in indicating the severity of the disease.

The capital loss to the cultivators and landowners of the Delta is already somewhere between ten and twenty lakhs. This takes no account of the loss of excise revenue to Government amounting to Rs. 1-8-0 per dead tapped tree per annum. If once the disease reaches the large coconut-growing districts to the south, the loss will run into crores, unless the effective methods of checking are thoroughly carried out. In the Godavari Delta, palms form the most valuable economic asset of the people, furnishing them with an extraordinary number of every-day appliance, food, fuel, and the essential parts of their dwellings. In some villages 70 per cent. of the palms have been killed, and this loss will change the whole economic conditions of the Delta if not checked.

My investigations showed the disease to be due to a new form of fungus, belonging to an obscure group. I had fortunately been engaged in an extended study of this group for several years, and it was this fact that enabled me rapidly to work out some of the main features of its life history and to suggest practical measures for checking it. The information already available has been published in the *Agricultural Journal* for October 1906 and in *Memoir No. 5, Botanical Series*, of the Department. Further detailed study on the spot is necessary to elucidate all the conditions of attack, but should extend over six months or more to yield full information and it is impossible for me to leave my laboratory for so long a period.

The suggestions for treatment were adopted experimentally by the Madras Government and operations commenced in December 1906 at an estimated cost of Rs. 5,000. The perfect feasibility of these operations having been proved by three months' trial, their extension to the whole area has been recently jointly recommended by the Collector of Godavari, the Director of Agriculture, Madras, and myself and I understand that full measures for stamping out the disease are now assured. If these are thoroughly carried out I am confident that they will meet with entire success.

The parasite gains entrance to the leaf sheaths surrounding the apical bud of the palm. It penetrates these one after another, until the bud is reached and the tree dies. Two sorts of spore have been found, which germinate only under certain conditions. These convey the disease from tree to tree, but how is not certain. Infective material is only produced at certain stages. The activity of the parasite reaches its height about December. The facts ascertained would ordinarily have taken months of enquiry to work out, but for previous knowledge of all allied forms, gained chiefly by laboratory work, and this case indicates strikingly the value of research. Further useful knowledge of the specific action of the parasite on palm trees, the method of infection, the particular functions of the two spore forms, the conditions governing their production and germination, and the relations between host and parasite, await the strengthening of the Mycological staff sufficiently to depute a trained Mycologist for prolonged local investigation. It is a good example of the sudden appearance of a new disease, of which the coffee leaf disease in Ceylon, the potato disease and the vine mildew in Europe are well known cases,—requiring the application of knowledge gained by long continued research in checking.

The treatment was based on the facts that infection passes from tree to tree by the wind, birds or some unknown agency, but can only carry a short distance; that infective material is only produced in the inner layers of the bud and not very early

in the attack ; that infection takes place through the outer leaf sheaths, and requires moisture and other seasonal conditions for its success ; and that heating destroys the parasite in its entirety and Bordeaux mixture prevents the germination of the spores.

No local trained assistance was available. Three working parties were formed, each in charge of a Revenue Inspector. Village returns were obtained through the village officials. Each village in a certain area, reporting the existence of the disease was visited in turn. A local staff of palm climbers (toddy drawers) was recruited, the trees were marked and all diseased trees climbed and the tops cut. Neighbouring healthy trees were climbed for Bordeaux mixture treatment. One man could cut 15 trees or treat 35 in a day and the cost worked out at about 2 annas and 1 pie, per tree, respectively. An assistant from the Madras Government Botanist's staff was in supervising charge, but had no Mycological training and no field experience. No better provision was available.

The new proposals provide for the treatment of the whole affected area, taluq by taluq. The total cost is estimated at Rs. 30,000. Two Indian assistants will be lent from my establishment and two provided by the Government Botanist, Madras. Application has been made for a junior officer of the Civil Service (an Assistant Collector) to take charge of the operations, and this recommendation, strongly supported by the Collector and the Director of Agriculture, emphasises the need of sufficient European staff to deal with large campaigns of this nature. For the want of scientific training will seriously reduce the efficiency of the control. I shall have to give frequent visits to the scene of operations instead of being able to depute a trained European Mycologist to take charge of the work. Superior control has been found necessary, even though effected by a non-scientific officer, in order to check fraud for which there are many openings.

In the scheme proposed for extending Mycological sections in India the original investigation would have been entrusted to one of the superior staff at Pusa, who could have remained for as long as was necessary to work out the disease fully. He would be assisted by the local staff in field enquiries and could direct their work to elucidating many of the field conditions which it is of importance to note. We would have submitted our results to the Director of Agriculture, Madras, and planned the campaign in consultation with him. The field operations would have been carried out by the Provincial staff, strengthened if necessary, by one or two Assistants from Pusa and controlled in a large measure from Pusa. One of the European staff from Pusa would probably have to spend six or eight months in the Delta during the field operations or could visit it frequently, but this could be provided for out of the staff suggested, for it is but rarely that more than one large campaign of this nature will occur in any one year.

I think this case furnishes a strong argument in favour of the proposals for strengthening the central staff now submitted and shows, in its most favourable light, the particular directions in which trained Indian assistance and local knowledge will prove useful.

E. J. BUTLER,
Imperial Mycologist.

APPENDIX III.

WORK IN ENTOMOLOGY.

The assistance which Provincial Agricultural Departments can obtain from the Entomological Section at Pusa, can, to some extent, be estimated by the following information. The present Pusa trained staff for Entomology consists of:—

<i>European.</i>	<i>Rs.</i>
The Imperial Entomologist	750-50-1,000
Second do. (expected to join soon)	500-50-1,000.
Supernumerary Entomologist	{ 400-30-460. ' 500-50-1,000

<i>Indian.</i>	<i>Rs.</i>	
1 Special Assistant	200- 5-250	
1 Sericulture Assistant	100- 5-150	
4 Assistants	75-10-125,	each
1 Fieldman	50- 5-75.	
6 Fieldmen	30- 1-50,	each.
3 Setters	30- 4-50,	"
2 Laboratory keepers	10- 2-20,	"

2. In order to undertake original research and help the Provinces as far as possible in practical enquiries and work, the following Indian staff will probably soon be appointed :—

	<i>Rs.</i>	
1 Assistant	250-400	
1 Do	150-300.	
1 Do	150-250.	
1 Assistant for Sericulture and Bees	150 400.	
6 Assistants	100-150,	each.
9 Fieldmen	30-75,	"
6 Setters	20-40,	"
2 Laboratory keepers.	10-20,	"

3. Mr. Lefroy considers that at Pusa, where the work of each Assistant will be closely watched by himself and two other European Entomologists, he does not require men of exceptional educational qualifications. The Secretary of State has not sanctioned a European Entomologist for each Province. Therefore Mr. Lefroy would prefer to post to the Provinces men who have been partly trained in England. Such men may show special individuality or originality in their work and are, therefore, more suitable for the Provinces than for Pusa.

4. The investigation at Pusa should form a basis for the extensive work in each Province. Questions, such as the utilization of beneficial insects, the means of spreading parasites, the value of fungoid diseases of insects and the part played by birds in destroying insects, should be investigated at Pusa or by investigators from Pusa.

5. In the Pusa Insectory the life histories of injurious insects will be worked out in the greatest detail. All stages will be painted by trained artists. Insects destructive to crops and other insects will be collected, identified and preserved. In time a complete collection of the insects of the agricultural areas of India will thus be formed.

6. In collaboration with other experts on the Imperial staff insecticides and other methods of checking insects will continue to be investigated in the laboratories and in the fields of Pusa.

7. Pusa will provide instruction in Entomology, a long course for the Provincial Assistants and a short course for fieldmen.

8. When serious damage is being done by insects over wide areas, the Imperial Department must be in a position to give prompt assistance to the Provincial Departments or combine the work of two or more departments so as to secure the most efficient work. This has been found necessary recently as regards the migratory locust and boll-worm outbreaks.

9. Mr. Lefroy describes the entomological work which should be done in each Province as follows :—

- (a) Enquiry into the prevalence, behaviour and seasonal occurrence of injurious insects in the various tracts of the Province; into the injury caused to crops; the attitude of the cultivator towards these pests, the measures he adopts to check them and his willingness to adopt other remedial measures.
- (b) The examination in the field, as they occur, of all injurious and other insects.
- (c) The collection of specimens of injurious insects and the forwarding of those when necessary, for proper identification to Pusa.
- (d) Testing remedies on Farms and modifying these to suit local conditions.
- (e) Urging on the cultivators such simple remedies as have been found suitable, whenever losses in crops are noticeable.

- (f) Systematically spreading among the agricultural classes accurate information about insect life which injuriously or beneficially affects agriculture. This information should include the exhibition of collections by lantern slides in school rooms, fairs, etc., the publication of vernacular leaflets and village to village tours to demonstrate simple facts.

10. In reference to the Provincial establishment proposed under paragraph 12 of his general proposals, Mr. Lefroy advises that the work of the Assistant Entomologist should be executive, practical and chiefly in the field. He should not attempt systematic work that can be done at Pusa. He should direct and, as far as possible, control the work of the fieldmen. He should collect specimens of injurious and beneficial insects for Pusa and form at the Provincial College (a) the students' economic collection, (b) a reference collection of all economic insects of the Province, (c) a general collection of all insects of the Province.

11. The Laboratory Assistants' work should consist of—

- (a) Teaching entomology to students.
- (b) Care of the Collections.
- (c) Experimental and practical work on the College Farms and in the vicinity.

12. A field Assistant and a fieldman will be required for each Government farm and well-defined agricultural tract. The work of the field assistants will be to watch for the occurrence of a pest, to study it on the spot, to at once communicate the occurrence to the Assistant Entomologist and demonstrate practical remedies. In a serious outbreak all the fieldmen of the Province should be gathered in the affected areas. Ordinarily each field assistant should tour, talk to the people, instruct them, collect specimens of injurious insects, maintain on the Government Farm a small exhibit collection for demonstration and keep at hand such insecticides as may be ordinarily useful.

13. Mr. Lefroy explains that during the last two years Provincial Assistants have met in Conference at Pusa. This annual meeting is very useful and should be a definite feature in the year's work.

APPENDIX E.

POULTRY-FARMING IN INDIA

My Dear Sir,

May I call your kind attention to the following article which appeared in the *Indian Planters' Gazette* and beg your kind assistance in promoting the industry. I am sure the matter will commend itself to you, and thanking you in anticipation.

I am, dear Sir,

Yours faithfully,

H. E. ABBOTT.

POULTRY-FARMING IN INDIA.

It has been a great disappointment to us, and also an extreme regret, that in all the schemes for the agricultural regeneration of India, which have been mooted and considered since Lord Curzon established the Agricultural Bureau, the valuable adjunct of poultry-farming finds no place. Two annual meetings of delegates from all parts of the country have already been held at the Research Institute at Pusa, and in the first number of the *Agricultural Journal for India*, officially published the other day, Mr. F. G. Sly, the Officiating Inspector-General of Agriculture, has in a very interesting manner sketched the outlines of the general scheme for the expansion of the Imperial and Provincial Departments of Agriculture, which has become possible with increased expenditure justified by the stability of exchange and the prosperity of the finances of the country. He very rightly claims that the Department of Agriculture in India should occupy the first position in the administration of a country where the land revenue is such an important source of income, and where famine makes such appalling inroads on the national prosperity. But neither at the conclaves at Pusa nor in Mr. Sly's exposition has there been said a single word of the value of poultry-culture, which in one form or another has become a really valuable industry in Europe, America, and Australia, one in which much capital is invested, and the returns from which form a considerable item in national food and wealth. The neglect of so potential a source of revenue in India is to us little short of amazing, especially as the authorities cannot plead in excuse that their attention has not been drawn to the enormous field the country presents for the profitable pursuit of this essentially modern cult in economics. In the fall of 1900, the first year of the new century, Mr. H. E. Abbott, one of the oldest and most optimistic fowl fanciers in India, started the *Indian Fowl Fanciers' and Farmers' Journal* with the avowed intention of encouraging the breeding of poultry among the poorer classes of Europeans, Eurasians, and Native Christians to raise them from a slough of poverty and despondence into which they had been plunged by the tradition, we might almost say the fetish, of shiftless and improvident living. The journal was an immediate success and has since been steadily growing in popularity and influence. The enthusiastic Editor has kept pounding away on the value of poultry-farming to solve a large part of the problem of the Domieiled, a problem that has baffled the most astute of our legislators. He has supported his opinions by practical demonstration on his farm at Jaintpore. He is constantly importing from England the best breeds of utility poultry and loses no opportunity to prove the profitableness of such investment. Month after month the journal records the enormous advances made in the industry in Europe, America, and the Colonies, and with sturdy independence rebukes the Government for failing in a duty which is as plain as it should be compelling. We are told of successful individual effort in every part of the country, and then asked to say what we think of the supineness of an administration which allows such a certain and lucrative means of revenue to slip. We must repeat that the official indifference is simply amazing, and it makes one inclined to concede to Dr. Emil Reich, author of "Success Among Nations," the justice of his allegation that the English official is singularly inelastic and must be driven by a goad to meet new exigencies. Mr. Abbott's clever little paper has done very much during the past five years to educate its readers in poultry-keeping; it is a welcome guest in the

library of more than one Secretary to Government; and it proclaims the fiscal value of the hen with the clarion note of a chanticleer. Yet both Pusa and the Agricultural Bureau are deaf to the call, and would probably fall down in a scientific fit, if asked to contribute a portion of the annual grant of twenty lakhs of rupees to the promotion of poultry-farming in India on a large scale. Before going further it may be useful to draw the attention of Mr. Sly to the attitude of the English Board of Agriculture and Fisheries towards the industry. Last year it issued some very valuable hints to farmers on the feeding of Poultry which were prefaced by the following significant remarks:—"There is a widespread belief that poultry keeping can never be made a great industry in the United Kingdom, by reason of the large amount of labour entailed and the great cost of upkeep in the way of food. No idea can be more incorrect, though there is at present an unfortunate tendency in many quarters to look upon poultry-keeping as a sort of hobby, and moreover, there is a serious wastage in the matter of food and labour. So far as cost of keep is concerned, co-operation in buying will work wonders, while, as to the saving of labour, experience is all that is necessary." We would hardly put the case for India more trenchantly.

Poultry-farming has reached its highest development in the United States of America, owing to an inexhaustible market. The Americans consume much less butcher's meat than we English do, and poultry and eggs are rapidly replacing it as the national food. It would be well if the Anglo-Indian followed this excellent example. It would reconcile him to the fact that *moorighi* is ever a most important item in the dāk bungalow bill of fare, and, what is of more consequence, the demand thus created would result in the rearing of a better class of fowl for the table. From an excellent article on the subject of poultry-farming contributed by Lewis Wright, the author of "The New Book of Poultry" to the latest edition of the *Encyclopædia Britannica*, we learn that the poultry industry in the United States is the most gigantic in the world, and probably the greatest pecuniary interest the country possesses. By the census of 1900, which tabulates returns from 5,096,252 out of the 5,739,657 farms in the States, the number of fowls over three months old on 1st June 1900 was returned as 233,598,065, with 6,599,367 turkeys, 5,676,863 geese, and 4,807,358 ducks, or 250,681,073 birds in all, valued at 85,794,966 dollars. This, however, would include very few of the chickens raised that year which would not have reached the age stated, and mainly represents breeding and laying stock, which thus average about 49 birds to every holding; it also of necessity omits many of the smaller city-lot raisers. The value of the poultry raised during the whole year 1899 is given as 136,891,877 dollars and of the eggs produced (1,293,819,186 dozen) at 144,286,186 dollars; a total year's product of over £56,000,000. Adding only a very moderate amount for city-lot and other small producers not making returns it will be seen that the poultry industry in America exceeds in value either the wheat crop, or swine crop, or cotton crop, which probably comes next in value. Is not this enough to spur our Government to strenuous endeavour, especially when we find that both in Australia and Canada the authorities, stimulated by the example of the United States, make considerable efforts to encourage poultry? Were it not that we would greatly exceed the limits of a leading article, we would quote the Continental statistics to show the rapid advance and the increasing importance of the industry in France, Holland, Belgium, Germany, and even Russia, during the last decade of the nineteenth century.

Having written so much of the value of poultry-farming as a national asset, we may turn our attention to the immediate requirements of India. Anybody who has taken an interest in the subject and watched the signs of the times must be convinced that something will have to be done, and at once, if the *moorighi* is not to disappear entirely from our tables. The drain on indigenous poultry, always raised by the natives in the very haphazard sort of way, is enormous and the supply is slowly but surely giving out. Considering the extent of the country, the number of natives that go in for it is microscopic, and it is our experience that the denizens of the *paras* are becoming more and more discouraged. The necessity to save the industry from extinction is an imperative duty of the State, and we think of no better way than for the Government of India to issue to the local Governments a circular enjoining on them the duty of employing a portion of the provincial grant to assist native professional poultry-keepers. Poor Whites, and Christian Missions to obtain from England and elsewhere the best breeds of

utility poultry and thus start an industry the future of which is secure. Most of the railways in India are owned by the State and the operations of the few companies that remain are controlled by the Government. Nothing would, therefore, be easier than to send a recommendation, which would have force of an order, to the railway directorates to encourage and assist their poorer employés to rear poultry and thereby make a much-needed addition to their scanty wages. Safe and cheap transport by special poultry coop wagons on all Indian lines would be an important item in the general scheme, and it would present no difficulty to a sympathetic and determined Member for Commerce like the Honourable Mr. Hewett. Knowing what we do of the great shipping companies that draw much of their wealth from India, we entertain no apprehension that they would refuse to assist the great industrial experiment we are advocating, by carrying fowls from England at low freight and providing proper coops to ensure their being landed strong and healthy. In Mr. Sly's article in the *Agricultural Journal for India*, to which we have already referred, he says that it is contemplated to have an experimental farm for each important distinct agricultural tract in India. We contend that the equipment of every such farm will be incomplete unless provision is made for a poultry department. It is unnecessary to labour the argument, for, beside the value of eggs and fowls, there is the exceptional advantage of the best manure that can be procured. Having accepted the poultry adjuncts to experimental farms, the next step of the Government will be the appointment of an expert controller and inspector with a position and independence of action similar to that enjoyed by the Veterinary Inspector-General. But by far the most important action we expect from Government is the holding of shows at important centres. The development of poultry culture in England owes nearly everything to the great number of poultry exhibitions during the last ten years of the nineteenth century. It is difficult for us in India to realise that in the height of the season the *Field* had criticised as many as twenty shows in one week in Great Britain. We cannot hope to attain to any such enthusiasm in India for several generations to come; but it is useful to record the fact to show how incumbent it is on Government officials, in the mofussil especially, to organise frequent poultry exhibitions and encourage native rajahs and zemindars to help such of their ryots as are not prohibited by caste prejudices to take up poultry-breeding as an essential of their existence. If Government would provide such men and the Poor Whites, to whom we have so often referred, with eggs and young stock from the Government dépôts, either gratis or at very nominal prices, the first great obstacle would be overcome and the industry would be launched on the fair way to success. Government aid in the way above indicated is imperative and it is also legitimate. We have in Lord Minto a Viceroy who is a great landlord at home and has done everything in his power to assist the prosperity of his tenants. He has come to us direct from Canada, where during his Viceroyalty the Government established several stations for official experiments in poultry culture. To him we can, therefore, appeal with a confidence we did not possess before he came among us to inculcate the lessons of his experience in the heads of the local Governments on whose initiative and support the success of any scheme of poultry-farming must necessarily depend. The planting districts of Behar, Assam, and the Wynaad, the mission fields of Chota Nagpur and Southern India, the military garrison stations where the Eurasian descendants of British soldiers congregate and the innumerable railway towns scattered over the length and breadth of the country, are all ready to join at once and *con amore* in the Government experiment we advocate, and Lord Minto will confer a lasting benefit on the country if he will lead this host of willing workers into so rich a pasture, which for the present is unfortunately *incultum ac derelictum solum*.